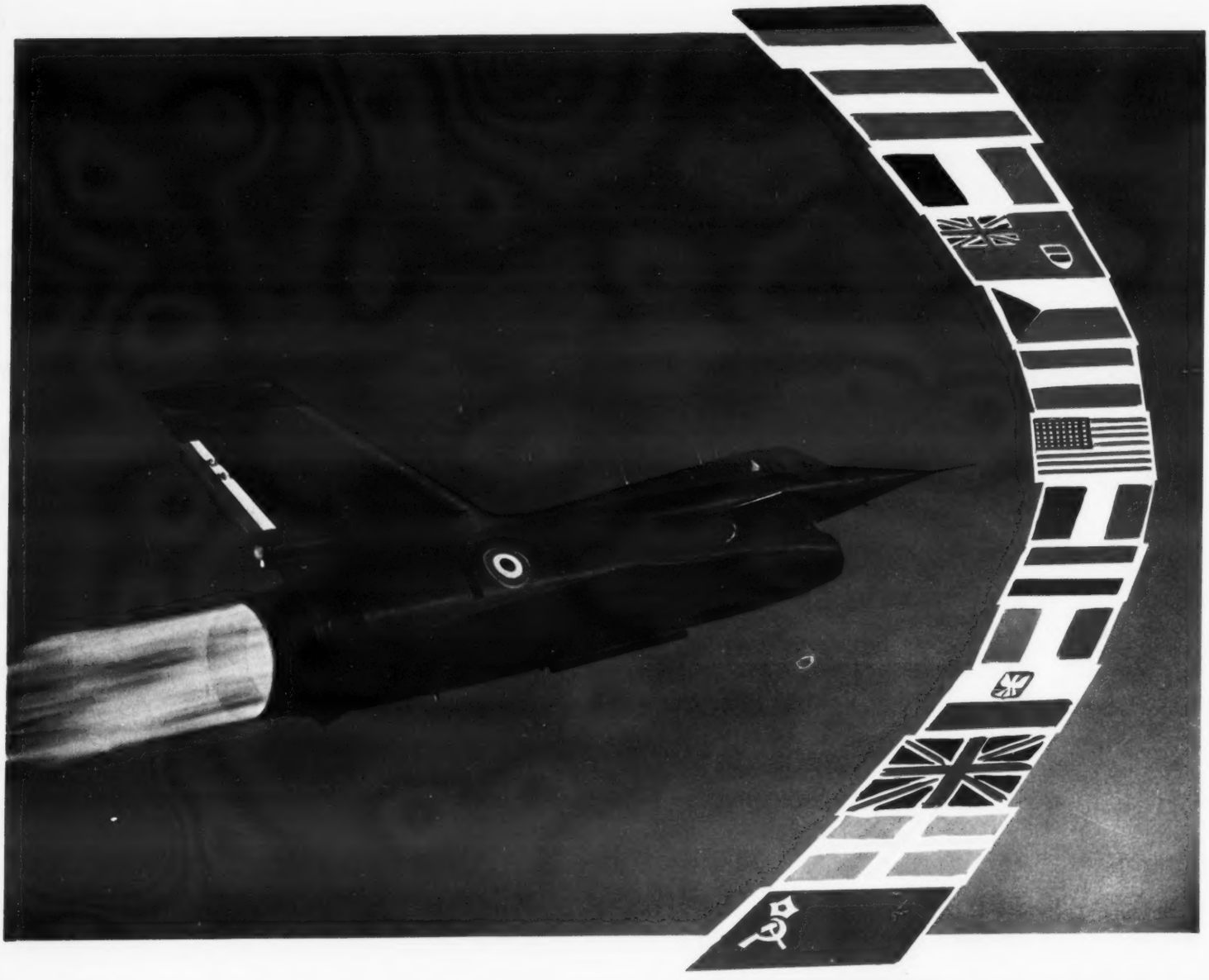
INTERAVIA

WORLD REVIEW OF AVIATION AND ASTRONAUTICS



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Guide to the Paris Air Show

VOLUME XIV

No 6/1959

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Volume XIV

INTERAVIA

June 1959

WORLD REVIEW OF AVIATION AND ASTRONAUTICS

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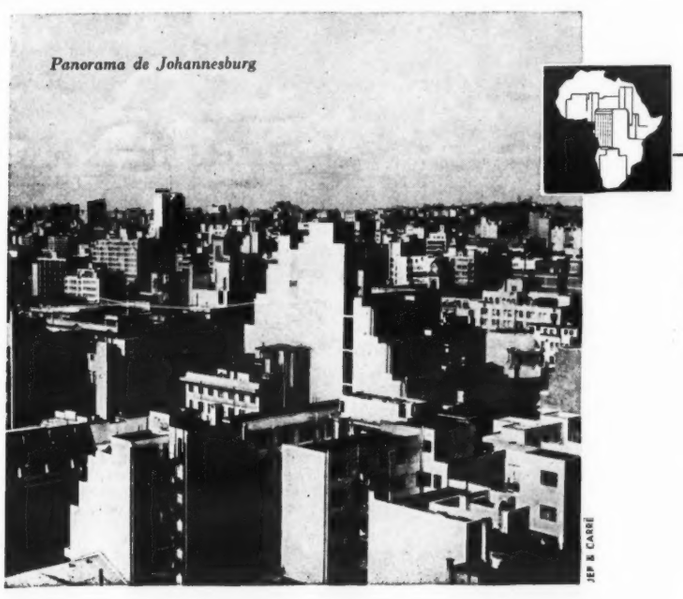
FRONT COVER : France enters the lists at the 23rd Paris Air Schow with an ambitious experimental aircraft, the Nord 1500 *Griffon* (with combination powerplant consisting of a SNECMA *Atar* plus a Nord-Aviation ramjet), which has attained speeds equivalent to Mach 2.08 in level flight at 62,250 ft., is reportedly to serve as basic design for future high-speed military aircraft. — Right, the flags of the 14 exhibiting nations, arranged in alphabetical order according to their names in French.



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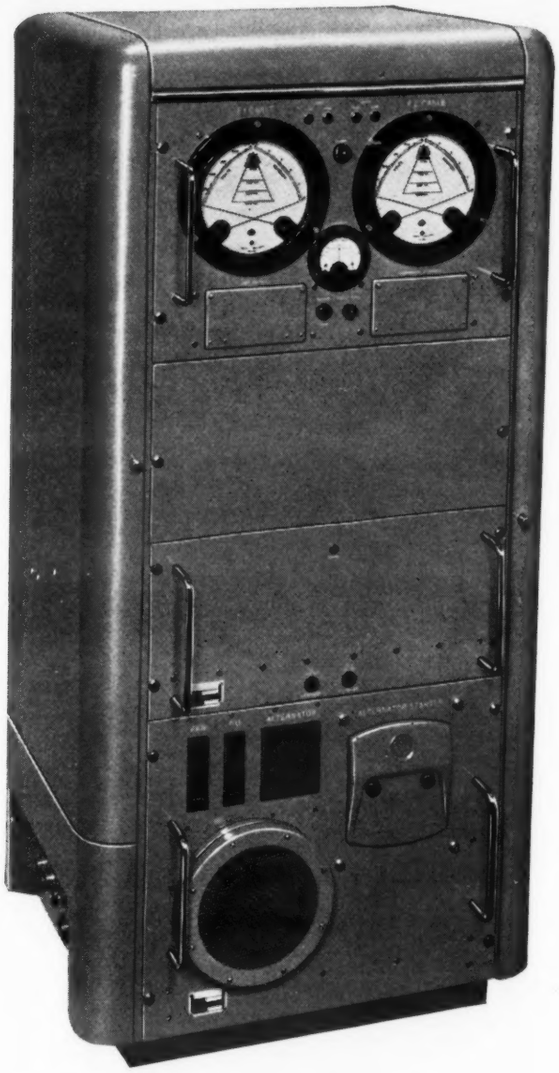

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H. RIECK

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E. BAUR, K. REGELIN

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Circulation
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Offices :

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Correspondents :

Amsterdam : Henk A. JANSEN; *Antwerp :* Roger F. J. GILLYNS; *Athens :* Manos PAVLIDIS; *Bombay :* K. K. ANCHAN; *Johannesburg :* J. K. CHILWELL; *Linköping* (Sweden): Sven WALBERG; *Los Angeles :* Norman LYNN; *Madrid :* Luis SAENZ DE PAZOS; *Melbourne :* Kenneth GREEN; *Mexico City :* José VILLELA, Jr.; *Tokyo :* N. MATSUMURA; *Toronto :* M. WILLMOT; *Vienna* (and South East Europe): Max W. MORSTADT.

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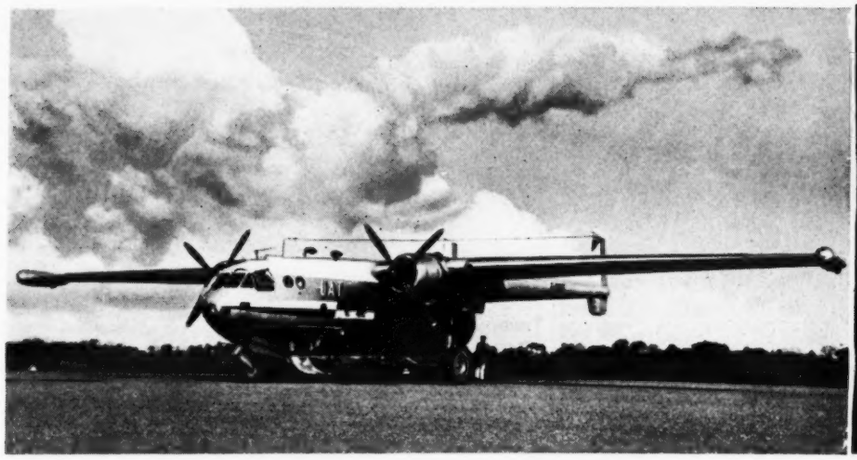

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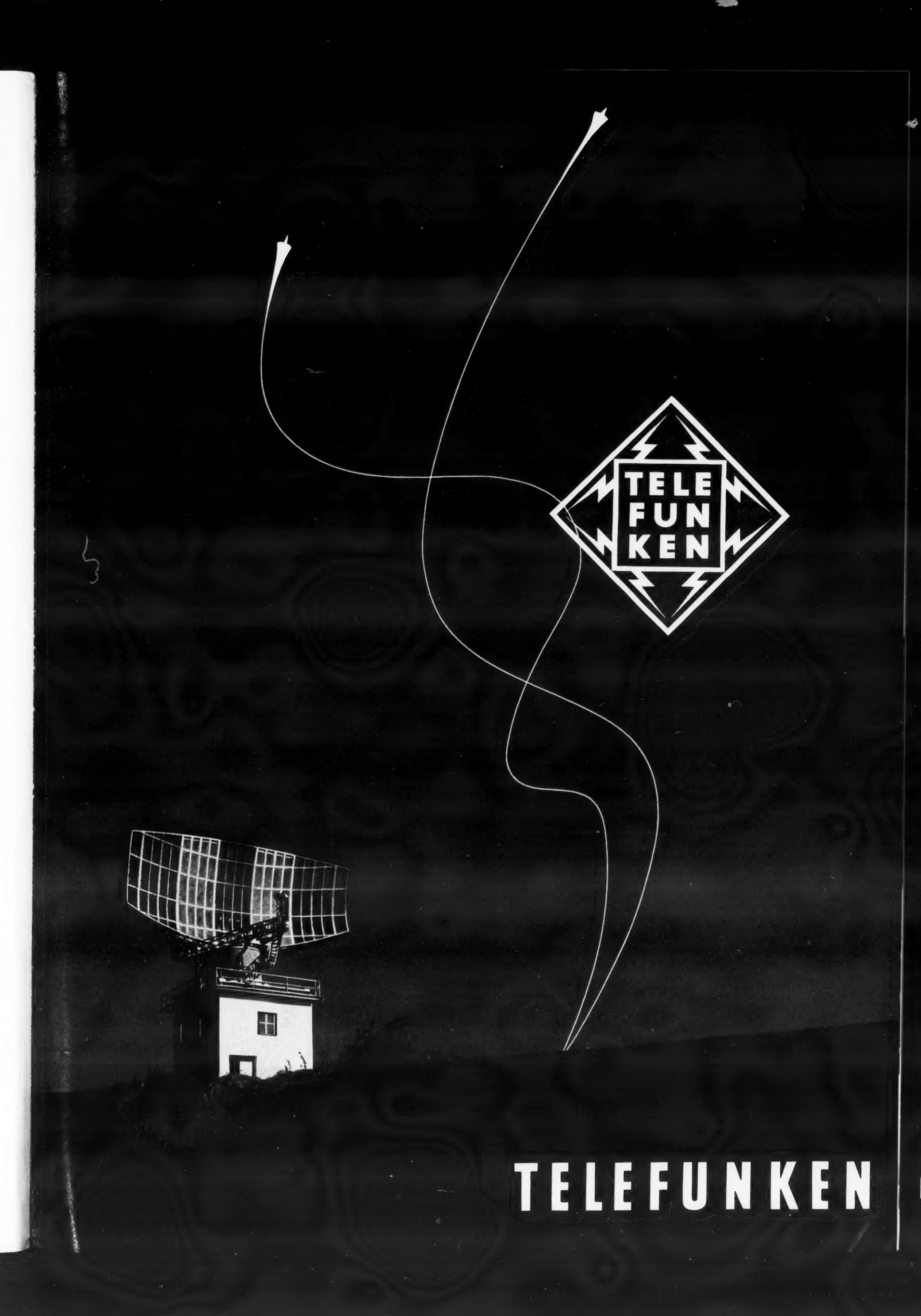
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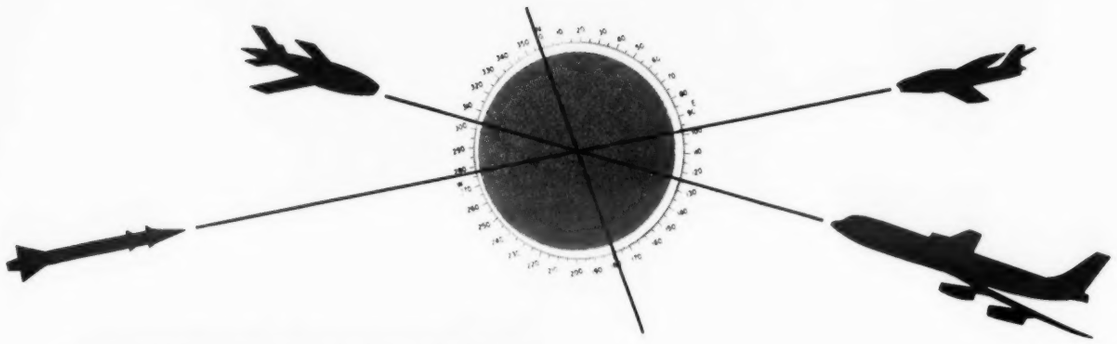

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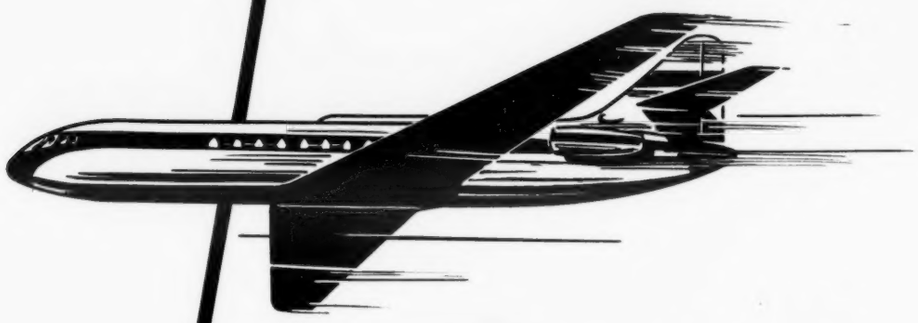

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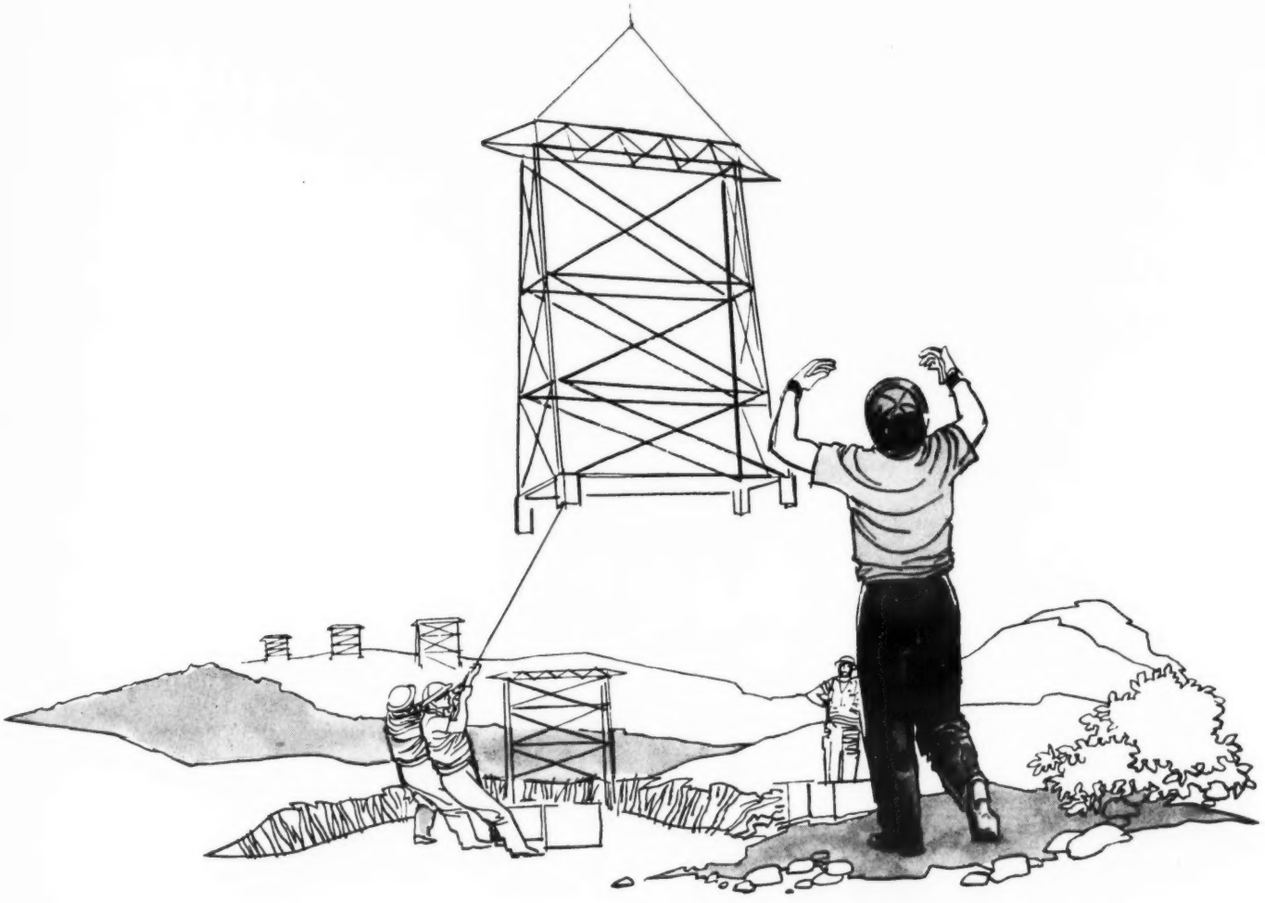

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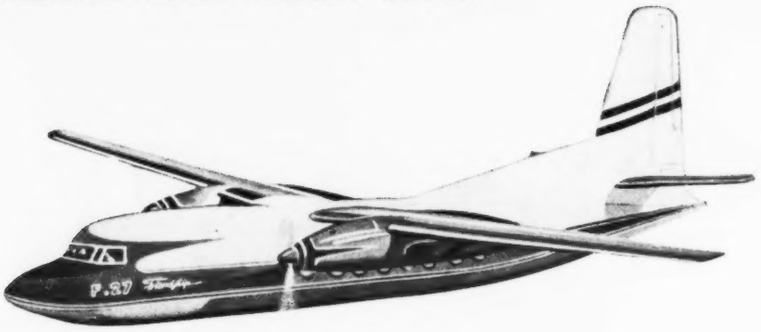

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Deadline Notes

Air France, Alitalia, Lufthansa and Sabena Presidents all held Press conferences on May 27th to announce agreement between the four carriers on the creation of a new group organization, *Air Union* (formerly discussed under the provisional title Europair). KLM, Royal Dutch Airlines, withdrew from the earlier discussions following disagreement on individual carriers' shares of the common traffic volume. The agreement applies only to the carriers' international lines, and French Community and Belgian African traffic will remain in the hands of the national carriers. Air Union represents an amalgamation only in the commercial field, and the project will come into operation in summer 1960. Quotas for future traffic, which make allowance for the growth of the German and Italian companies, are (with present figures shown in brackets) : Air France 34 percent (50) ; Lufthansa 30 percent (17.4) ; Alitalia 26 percent (14.7) ; and Sabena 10 percent (17.7). Air Union's permanent secretariat will be located in Paris. The four carriers currently operate 334 aircraft and have a total of 57 jet aircraft on order (Boeing 707—Air France 17, Lufthansa 4, Sabena 5 ; Douglas DC-8—Alitalia 4, TAI 2, UAT 2 ; Sud Aviation *Caravelle*—Air France 24).

●

Zurich-Kloten Airport : work on the second stage of Kloten Airport development project has now been put in hand. The ILS runway is being lengthened to the south by 1,312 feet to give a total length of 9,850 feet. In the northern sector some 1.5 million cubic metres of earth must be moved to provide the necessary freedom from obstructions.

●

The Spanish flag-carrier Iberia (Líneas Aéreas de España S.A.) has extended its Madrid-Havana services to Mexico City. The new service will be operated on a once-weekly frequency in each direction departing Madrid on Thursdays and Mexico City on Saturdays.

●

The East German Lufthansa has signed interline agreements with the Greek carrier Olympic Airways, and Icelandic Airlines, Loftleidir.

●

Berlin-Schönefeld Airport : Concreting of the new 11,800-ft. runway to take jet traffic at Berlin-Schönefeld began this month. The 200-ft. wide runway is scheduled for completion this year. Work has also commenced on a jet transport runway at Schkeuditz (Halle-Leipzig) Airport. Schkeuditz is the location of the East German Aircraft Industry's repair and maintenance plant.

●

Budapest Airport recorded a total of over 19,000 aircraft movements during 1958, and handled approximately 250,000 passengers and 6,000 tonnes of freight. Radar equipment supplied by the Soviet Union is to be installed shortly. Budapest is currently served by eleven foreign carriers.

●

In exchange for BOAC rights in Toronto, the recent Canada-United Kingdom air talks in Ottawa granted Canada the rights to originate flights in Toronto destined for Hong Kong ; to originate flights in western Canada destined for the U.K. ; and rights in Europe between London and Brussels, Dusseldorf, Zurich, and Vienna. Canadian Pacific Airlines, already operating Vancouver-Hong Kong and Toronto-Vancouver, will benefit from the Toronto-Hong Kong agreement, while Trans-Canada Air Lines, currently operating between Canada and the European points, will have rights to take on passengers at London Airport.

●

Scandinavian Airlines System introduced the first *Caravelle* service on the route Copenhagen - Prague - Budapest - Istanbul - Damascus - Cairo on May 15th, 1959. Flying time has been reduced by one-third.

●

A British European Airways Viscount made the inaugural flight of a scheduled service between London and Moscow on May 14th. Aeroflot inaugurated the first flight on the new Moscow-London service two days later. BEA and Aeroflot will each operate a twice-weekly frequency between London and Moscow via Copenhagen.

●

Pan American World Airways now plans to introduce the Boeing 707-320 jet transport into service in the Pacific area by late August or early September. The carrier hopes to take delivery of the first 707-320 (four Pratt & Whitney JT4As) in July. Boeing Airplane Company says that the first two 320s to be completed are well advanced in the FAA certification testing programme, and completion is expected by July.

●

Northwest Airlines is inaugurating a one-stop round-trip service New York-Anchorage-Tokyo on June 6th, designated Polar Imperial Service, on a once-weekly frequency. Combination de luxe, first class and tourist services will be offered over the route, and the service will depart New York on Fridays. Eastbound flights will depart Tokyo on Saturdays.

●

Aerolineas Argentinas Comet 4 jet services to Europe were inaugurated on May 19th. The carrier's Buenos Aires-Rio de Janeiro-Recife - Dakar - Madrid - Paris - London service will have a flight time of 15 hours and 55 minutes ; return flight London-Buenos Aires, 17 hours 10 minutes. The carrier's second service via Rome and Frankfurt will have a flight time of 19 hours 20 minutes Buenos Aires-London and 19 hours 50 minutes on the return leg ; this service will leave Buenos Aires on Fridays, arriving in and departing from London on Saturdays.

●

W. G. Kibre, Chief Project Planner for Lockheed Aircraft Corporation's California Division, has been named Project Resident Director in Germany, with headquarters in Munich, to head Lockheed's activity during the manufacture of the F-104 *Starfighter* for the West German Government. Kibre will provide specialized assistance in planning and manufacturing phases to the four West German firms (Messerschmitt, Dornier, Heinkel and Siebelwerke) participating in the *Starfighter* programme.

●

Temco Aircraft Corporation has created a new Electronics Division, and established separate divisions for Missiles & Aircraft and Aircraft Overhaul and Modification. The Electronics Division, headed by A. R. Teasdeale, will have complete responsibility for design, manufacture, sales and field support of electronic systems and components for military, industrial and commercial customers.

●

The United States Air Force has revealed that last December a late-model Boeing B-52 jet bomber made a 9,000-mile, 18 and one-half hour flight without refuelling. The flight was conducted by Boeing Airplane Company during a 1,000-hour service test.

●

Raytheon Manufacturing Company's name has been changed to *Raytheon Company* to reflect broadened activities. Raytheon has requested the Securities and Exchange Commission to register 350,602 shares of $5 par common stock, and 100,300 shares of five-and-one-half percent $50 par preferred stock in connection with the merger of Machlett Laboratories Inc. into Raytheon.

●

Convair Division of General Dynamics Corporation has received an $8 million USAF letter contract for the procurement of long-lead-time items for 40 additional Mach 2 B-58 *Hustler* bombers. Initial B-58 contracts called for a total of 30 *Hustlers* and, in December 1958, the Air Force disclosed that it had ordered an additional 36. The new contract, which will implement production beyond the 66 ordered to date, will be funded from Fiscal 1959 appropriations.

●

Canadair Ltd. has now confirmed firm orders from The Flying Tiger Line and Seaboard & Western Airlines for ten and five Canadair CL-44 turboprop air freighters respectively. The contracts are reported to be worth a total of $70 million. The Canadair CL-44s, which are powered by four Rolls-Royce RTy.12s, will be able to transport a 65,000-lb. payload on North Atlantic routes at a top cruising speed of 400 m.p.h.

●

Aeroflot President Marshal Zhigarev and a team of Russian experts visited the United Kingdom at the end of May to investigate Decca-Dectra and the Pye ILS systems for Aeroflot. Zhigarev announced a £100,000 order for two Pye ILS systems for installation at Moscow Airport ; no announcement was made on a possible interest in acquiring Decca-Dectra. The automatic landing system was developed by the Royal Aircraft Establishment's Blind Landing Experimental Unit and Pye Telecommunications.

●

VEB Flugzeugbau is closing down production of the Ilyushin Il-14P, and final assembly of the 80th aircraft at Dresden is scheduled for completion by September 1st, 1959. Initial production of the Type 152 jet transport is scheduled to run at the rate of one completed aircraft every eight weeks.

●

The Dassault 415 Communauté made its first flight on May 10th, and continues testing at Bordeaux-Mérignac airport.

●

Professor Dr.-Ing. Claude Dornier, who celebrated his 75th birthday on May 14th, was awarded the Ludwig Prandtl Ring at the Third Memorial Lecture given in Ha-

nover on May 21st, 1959. This is the highest honour awarded by the Society for the Astronautical Sciences (WGL). The Society's two earlier awards were made to Professor Theodor von Karman and Professor Albert Betz.

●

The twin-engined Max Holste MH.250 Super Broussard prototype made its first flight from the company field at Reims on May 21st. The MH.250, powered by two Pratt & Whitney R-1340 piston engines of 600 h.p. each, was airborne for approximately one hour. The second prototype, now in assembly, will be equipped with Turboméca *Bastan* turboprops.

●

The prototype of the first Austrian twin-engined *SGP M.222* touring aircraft, manufactured by Simmering-Graz-Paukerwerke A.G. in Vienna, made its first flight on May 15th.

●

Hindustan Aircraft (Private) Ltd. of Bangalore made a profit of Rs 3,416,000 in 1957-58 (U.S. $1 = Rs 4.78). The company's aircraft manufacture and overhaul operations accounted for Rs 3 million of this figure. Sales turnover is reported as Rs 60,824,000 against Rs 50,498,000 in the previous year.

●

Richard S. Morse, President of the National Research Corporation, has been named Director of Research and Development for the Army with effect from June 1st. Morse succeeds Dr. William H. Martin who has resigned from the post.

●

The Finance Minister of the Chinese People's Republic on April 21st, 1959, presented a draft budget for 1959 calling for a 16 percent increase in military expenditures. Vice Premier Li Hsien-nien told the Second National People's Congress that 5,800 million Yuan ($2,400 million) will be allocated this year for defence purposes. Last year the figure was a round 5,000 million Yuan. The Finance Minister said that while defence expenditures would increase in 1959, the military portion of the Peking budget would drop from 12.5 percent to about 11 percent.

●

President Eisenhower has announced the appointment of General Laurence S. Kuter to succeed General Earle E. Partridge as Commander of the North American Air Defense Command; the appointment was made after consultation with the Canadian Government. General Kuter, currently commanding U.S. Air Forces in the Pacific, will move to Colorado Springs in July, and will be succeeded by Lieutenant General Emmett O'Donnell.

●

United States Forces spokesmen in West Germany have announced that the 487th Tactical Missile Unit's Martin *Matadors,* now replaced by the Martin *Mace,* are to be handed over to the West German Armed Forces. The handover follows the Federal Republic's order to the USA last year, for the supply of 24 Martin *Matadors.*

●

The first Danish Nike battalion took delivery of a complete set of *Nike* guided missile equipment (radars, launchers and vans) at Fort Bliss, Texas at the beginning of May. Major General Valdemar Jacobsen, Chief of the Danish Army Staff, accepted the equipment, provided under the Military Assistance Program. The 149-man Danish battalion commanded by Lieutenant Colonel H. G. Hanson, has been under training on the *Nike-Ajax* and *Nike-Hercules* missiles at the Air Defense Center since early 1958.

Workshop Briefs

The U.S. Defense Department announces that the first of eight Rocketdyne rocket engines for ARPA's giant *Saturn* booster vehicle was delivered to the U.S. Army's Redstone Arsenal in mid-May. The eight engines, with a total thrust of 1,500,000 lb. will form the first stage of the *Saturn*; each of the engines will therefore deliver a thrust of around 187,000 lb., or considerably more than the 150,000 lb. provided by the *Thor* and *Jupiter* engines from which they have been developed. The new engine is designated H-1.

●

Republic Aviation Corporation has been awarded U.S. Navy and Air Force contracts totalling $193,000 for experimentation on a magnetic pinch plasma engine for space propulsion. The engine would utilize a heavy gas like oxygen and convert it into ions and electrons, which in turn would be compressed in an invisible cylinder of magnetism and shot out of the rear at tremendous velocity. In experimental models, Republic has proved the basic theory behind the engine and has obtained curved electrodes which result in thrust-producing magnetic pinches.

●

The first test run of the Kiwi-A experimental nuclear reactor is to begin shortly. The reactor is to be used for basic studies of nuclear propulsion for rockets, under the Atomic Energy Commission's Project *Rover.* First tests will be made by the AEC's Los Alamos Scientific Laboratory at Jackass Flats, Nevada.

●

In the fourth Martin Titan ICBM launched from Cape Canaveral on May 4th, the second stage was separated from the first at altitude for the first time. As in the other three launchings, the second stage was filled with water ballast and not with the Aerojet-General engine projected for the production model. Object of the latest launching was to test the characteristics of the first stage shutdown in relation to the staging operation, as well as the flight controls and guidance system.

●

The emergency escape device which will lift the *Mercury* satellite capsule from the launching rockets in the event of malfunction during launching has now been tested for the first time at NASA's research centre on Wallops Island, Virginia. A number of small rockets on a long tripod atop the space capsule hoisted the one-ton capsule 2,250 feet into the air, where the tripod detached, and a parachute lowered the capsule to the water. It came down in the Atlantic near the research centre and was picked up by a helicopter.

●

General Electric has now unveiled both the turboprop and the turboshaft models of its T64 engine in the 2,600 h.p. power class. The turboshaft version (T64-GE-2) is designed for use in helicopters and delivers 2,650 e.s.h.p. at military rating, for a specific fuel consumption of 0.506 lb./h.p./hr; weight is 854 lb. The T64-GE-4 turboprop model weighs 1,079 lb. and delivers 2,570 e.s.h.p., with a specific consumption of 0.522 lb./h.p./hr. Flight testing of the new engines is due to begin in 1960.

●

Vertol Aircraft Corporation has released new data for the Vertol 107 multi-purpose helicopter (two General Electric T58s. See picture on page 664 of this issue) : overall length (with folded rotor blades) 44 ft. 7 in.; height 16 ft. 10 in.; cabin width 79 in. Gross weight 18,400 lb., payload (for a range of 115 miles with 20 minutes reserves) 7,200 lb. The civil version for air transport use has accommodation for 24 passengers; crew of three. Performance: vertical rate of climb (sea level) 750 f.p.m.; rate of climb, forward 1,650 f.p.m.; hovering ceiling out of ground effect 7,000 ft.; hovering ceiling in ground effect 8,500 ft.; cruising speed 150 m.p.h.; service ceiling 13,500 ft.

General Electric also announces the development of an improved version, the GJ805-23, of its well-known aft-fan jet engine. Compared with the CJ805-21, it has higher thrust and improved specific fuel consumption.

●

The Convair Division of General Dynamics Corp. has now released first data of the B-58 Hustler supersonic bomber which will be built in small numbers for the USAF until the early 1960s. Powered by four General Electric J79 jets, the bomber reaches speeds of over 1,300 m.p.h., or the equivalent of Mach 2 +. Gross weight is more than 160,000 lb.; internal fuel capacity over 15,000 U.S. gals. Provision is made for in-flight refuelling. Span 56 ft. 10 in., length 96 ft. 9 in., height 31 ft. 5 in., wing area 1,542 sq.ft.

●

Douglas Jetmaster is the designation of a proposed military version of the DC-8 *Jetliner* commercial transport. The *Jetmaster* would have speeds of almost 500 knots and would be capable of carrying roughly 80,000 lb. of freight, 175 troops with combat equipment, or 152 litter patients plus medical attendants. Loads such as these could be transported from the United States to Central Europe, for example, in roughly seven hours.

●

SNECMA and the Pratt & Whitney Division of United Aircraft Corporation signed a licence production and technical collaboration agreement on June 1st. The agreement will be backed up by Pratt & Whitney participation in SNECMA capital (approximately 10 percent). Under the agreement SNECMA acquires a licence for the manufacture and sale of all Pratt & Whitney civil and military engines now in quantity production, including in particular the J75, the JT4 civil version of which powers the Boeing 707 and Douglas DC-8; also covered is the exchange of technical data for the development and eventual manufacture in France of a J75 military version (thrust exceeding 25,400 pounds), to power the French military twin-jet Dassault *Mirage IV.* SNECMA's present design and production programme, which is now clear for several years ahead, includes *Atar 8s* for the Navy *Etendard IV, Atar 9s* for the Air Force *Mirage III,* Bristol *Hercules* for the *Noratlas,* VTO projects etc. SNECMA will now be in a position to offer a European-based spares organization and special overhaul facilities to those European carriers operating JT4-powered aircraft. The agreement between the two companies has been made with the full approval of their respective Governments.

Photo credits : Front cover : manufacturers ; p. 605: Interavia files ; pp. 624-636 : manufacturers (27), Interavia drawing (1) ; pp. 637-640 : manufacturers ; pp. 641-642 : manufacturers ; pp. 645-648 : Interavia files ; pp. 663-667 : manufacturers ; pp. 668-671 : manufacturers ; pp. 672-677 : manufacturers ; p. 678 : Interavia files ; pp. 689-690 : author (7), manufacturers (4) ; pp. 699-701 : Las Vegas News Bureau and manufacturers (8), Interavia (10) ; pp. 702-703 : Interavia files ; pp. 704-705: Howard Levy (2), manufacturers (10) ; pp. 706-707 : manufacturers ; pp. 709-711 : U.S. Navy (2), Howard Levy (1), manufacturers (8) ; pp. 712-714 : SAS (1), USAF (1), manufacturers (12), Interavia files (1) ; pp. 735-736 : manufacturers ; p. 737 : Interavia ; pp. 738-739 : manufacturers (3), Interavia drawings (7) ; p. 740 : USAF (2), manufacturers (1) ; p. 741 : Interavia files.

"The need for a high accuracy hyperbolic navigation system giving cover from ground level up to the highest altitudes used by commercial air transport is already being felt in some parts of the world, and it is the United Kingdom belief that the problems will become even more urgent when jet aircraft begin to operate in appreciable numbers. The United Kingdom is fully satisfied that the Decca Navigator System is potentially able to meet this need and the needs which will develop from the introduction of even higher performance aircraft, and believes the assertions it has made regarding the outstanding operational advantages conferred by the Decca System are unassailable."

Extract from the Final Statement by the United Kingdom Delegation at the Special Com/Ops/Rac ICAO meeting Montreal February 1959

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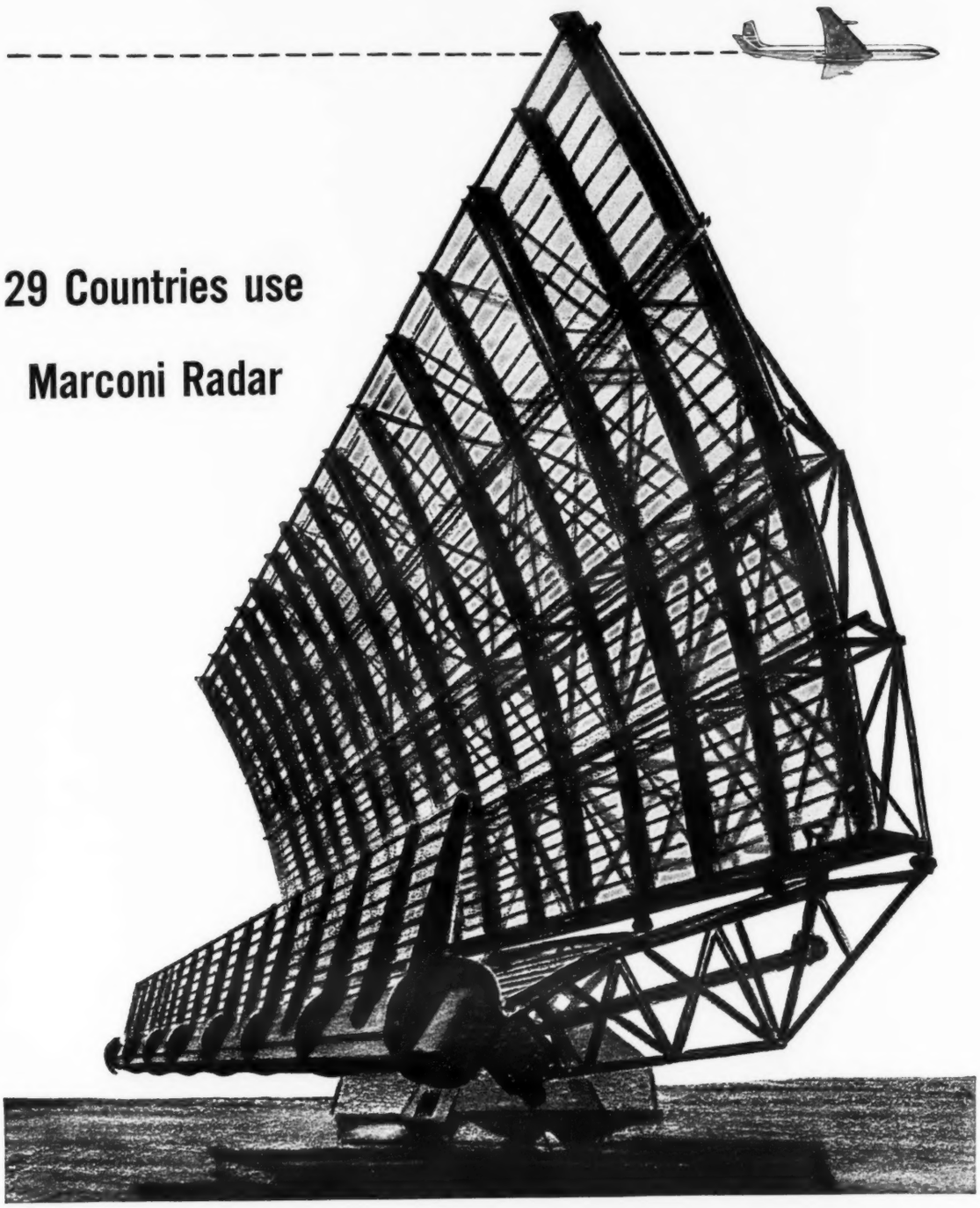

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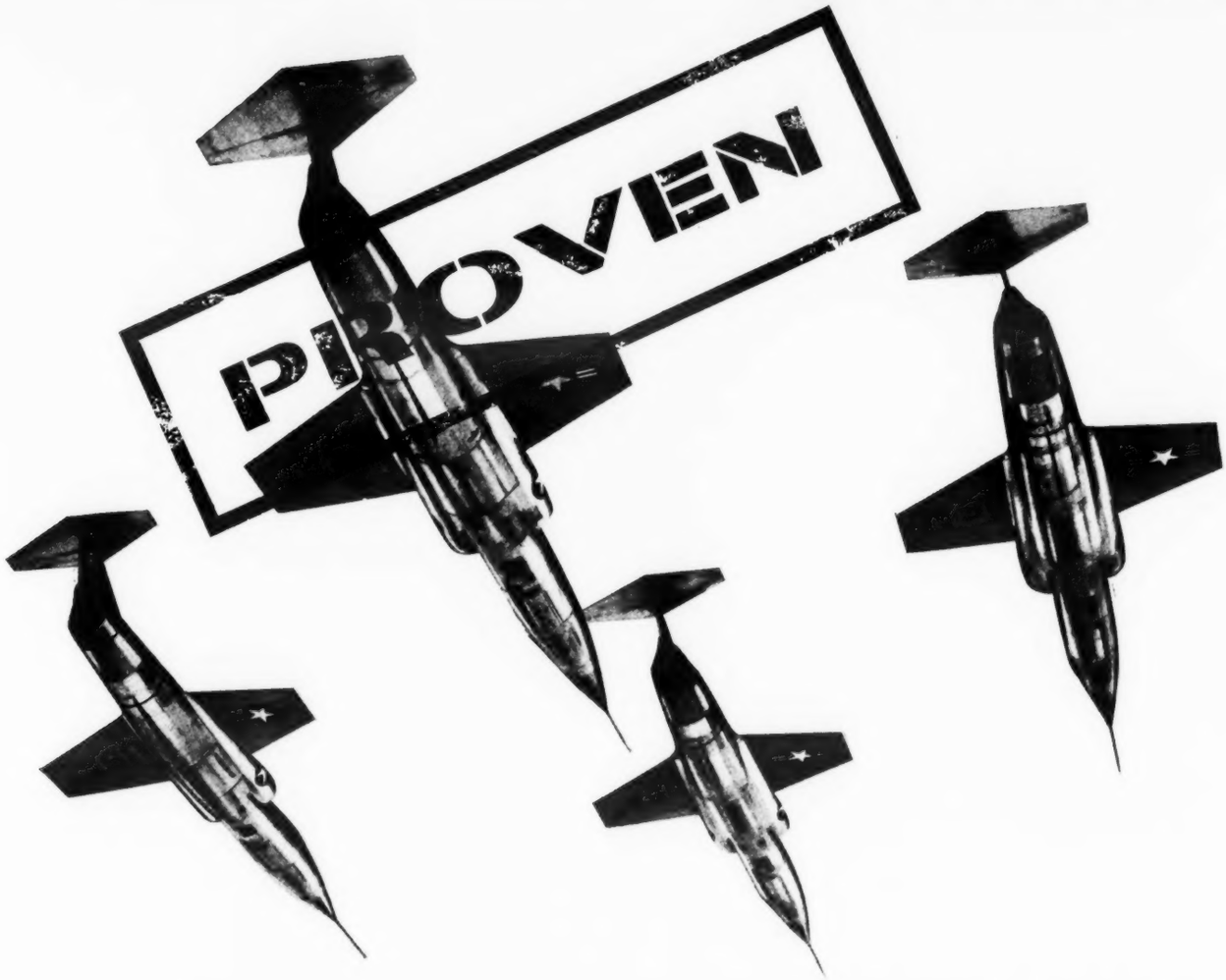

IN OPERATIONAL SERVICE

With the selection by West Germany of Lockheed's F-104 Starfighter, the services of the world's most thoroughly tested and efficient interceptor are made available to NATO defense forces.

In addition to its amazing multi-mission capability the F-104 has demonstrated the following advantages during more than one year's operational service with the USAF:

Low cost maintenance . . . PROVEN
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World's fastest (1404 mph) PROVEN
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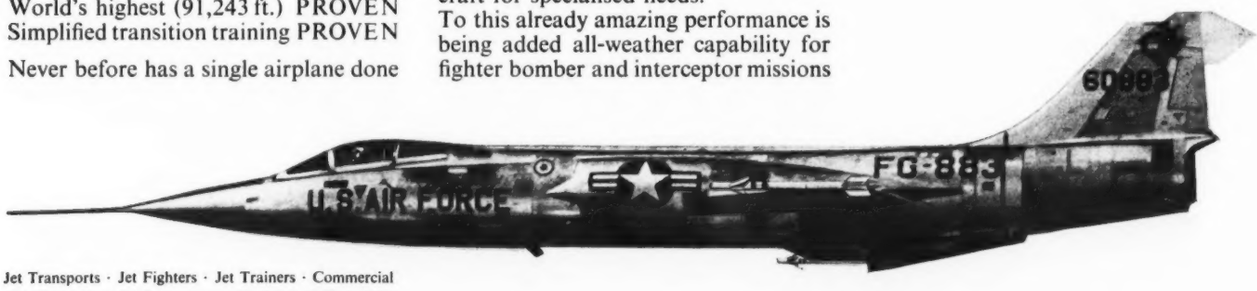
Never before has a single airplane done so many things so well as the present US Air Force version: Interception, Air Superiority and Bombing—and with so low proven maintenance and operating costs.

In addition to holding the world speed and altitude records the F-104 recently established seven time-to-climb records.

The famous "missile with a man in it" has been still further developed to meet the specific needs of West Germany and other allies requiring a multi-purpose fighter instead of several separate aircraft for specialised needs.

To this already amazing performance is being added all-weather capability for fighter bomber and interceptor missions and also an advanced reconnaissance capability.

West Germany selected the Starfighter for purchase and manufacture under licence after a two-year evaluation period during which Defense Ministry experts investigated and flight-tested airplanes made by 12 competing manufacturers. The licensing of German manufacturers to produce this advanced version will make it available to West European nations at relatively low cost.



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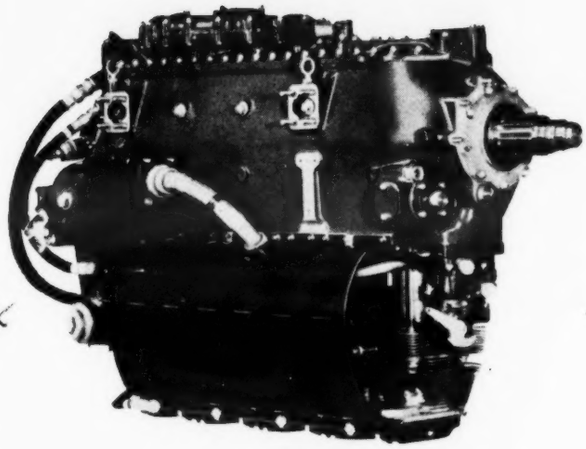

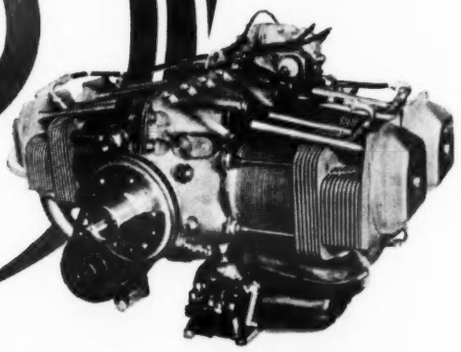

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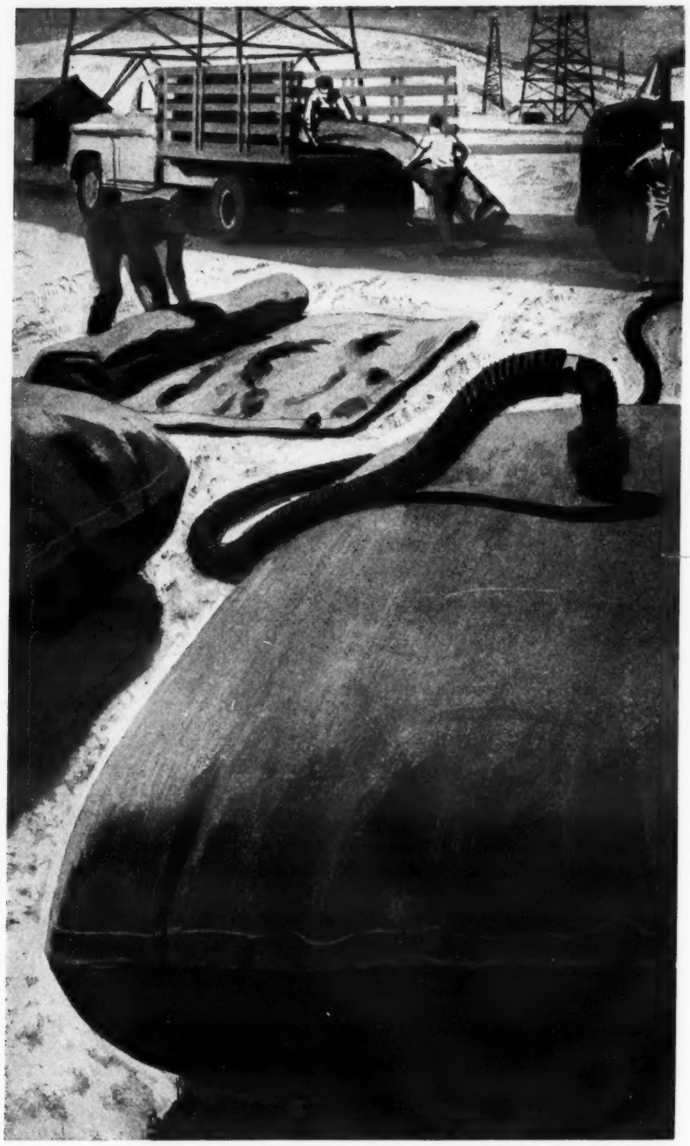
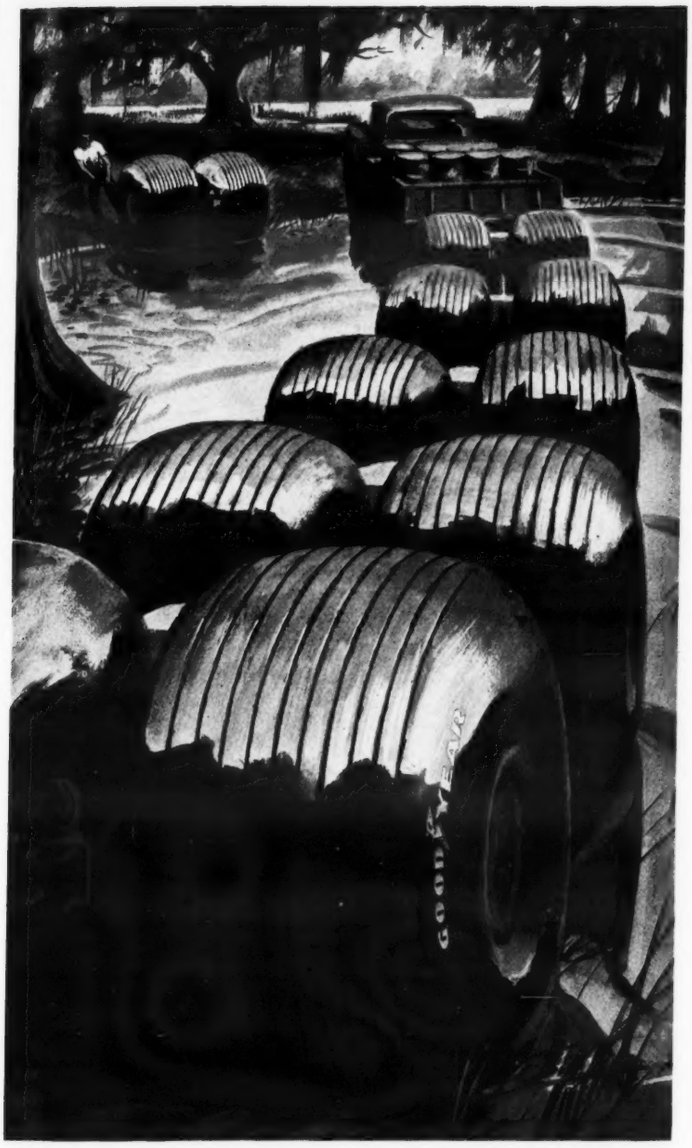
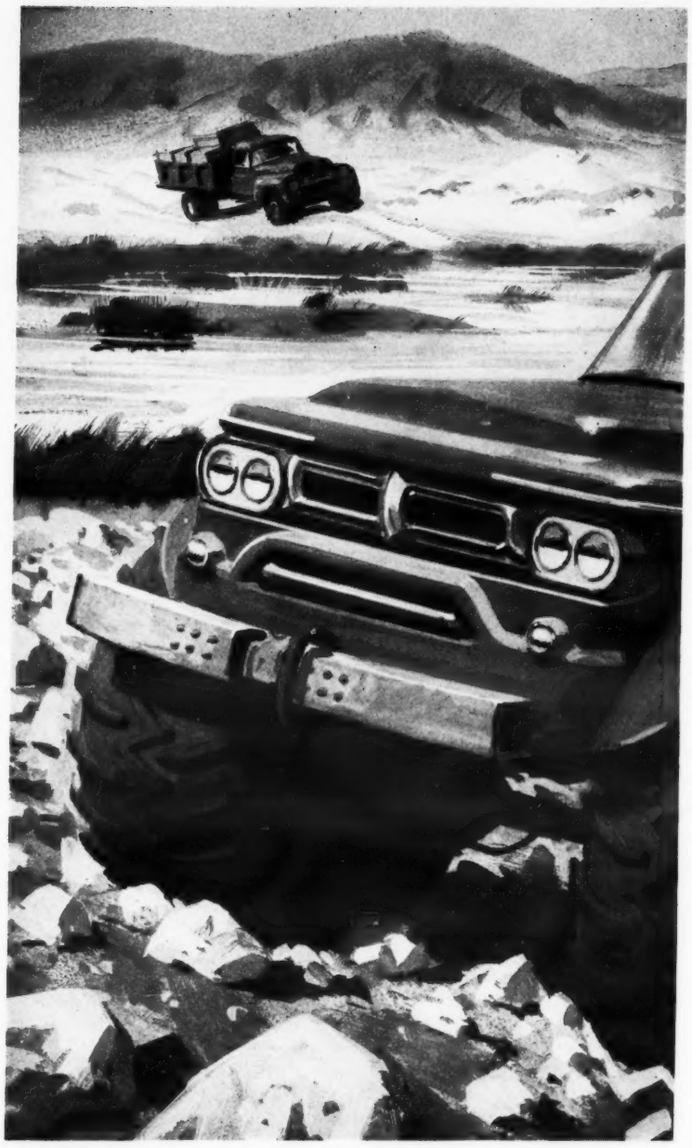


1 WANT TO SAVE ON FUEL STORAGE COSTS? Then, consider the "Pillow Tank"—tough, rubberized fabric container by Goodyear that unrolls like a rug, can be filled and pumping 45 minutes after delivery, eliminates need for heavy, hard-to-handle steel drums. Designed for all-weather use wherever temporary or emergency storage or transport of bulk liquids is required, "Pillow Tanks" are perfect for use on farms—in oil fields—at remote construction sites. Gasoline, oil, water—even granular solids—can be stored in these ingenious tanks. They are available in sizes up to 50,000 gallons, yet occupy only a minimum amount of space when rolled up.

GOOD





2 THIS IS THE ROLLI-TANKER. Tire-like tankers hold up to 500 gallons, glide over softest terrain without sinking in. Train of Rolli-Tankers can provide fuel and water along entire route of a road construction job. Taken in tow, they offer minimum rolling resistance, and free the truck itself to take its normal pay load of other materials. Regular work truck can unhitch Rolli-Tankers where needed and pick them up again after use. This eliminates need for tank truck—also eliminates transferring liquids to separate dispenser containers. Rolli-Tankers may also be towed through water. They have natural buoyancy, roll right up the beach. Or — Rolli-Tankers may be air-dropped into remote areas.

3 "GO ANYWHERE" TIRE is another name for the Terra-Tire, developed by Goodyear to give vehicles unprecedented mobility. Axle-driven and axle-loaded, these drum-shaped pneumatic tires conform to the ground contour—are virtually immune to punctures and blow-outs. One of their many applications: on trucks which must go into rough off-the-road areas during oil exploration. Tires have exceptional strength—due to all-nylon cord construction and exclusive *triple-tempering* process. High strength, combined with great flexibility, enables Terra-Tire to roll easily over rocks, stumps, other obstacles. And the ride is so cushion-soft that springs aren't needed.

YEAR

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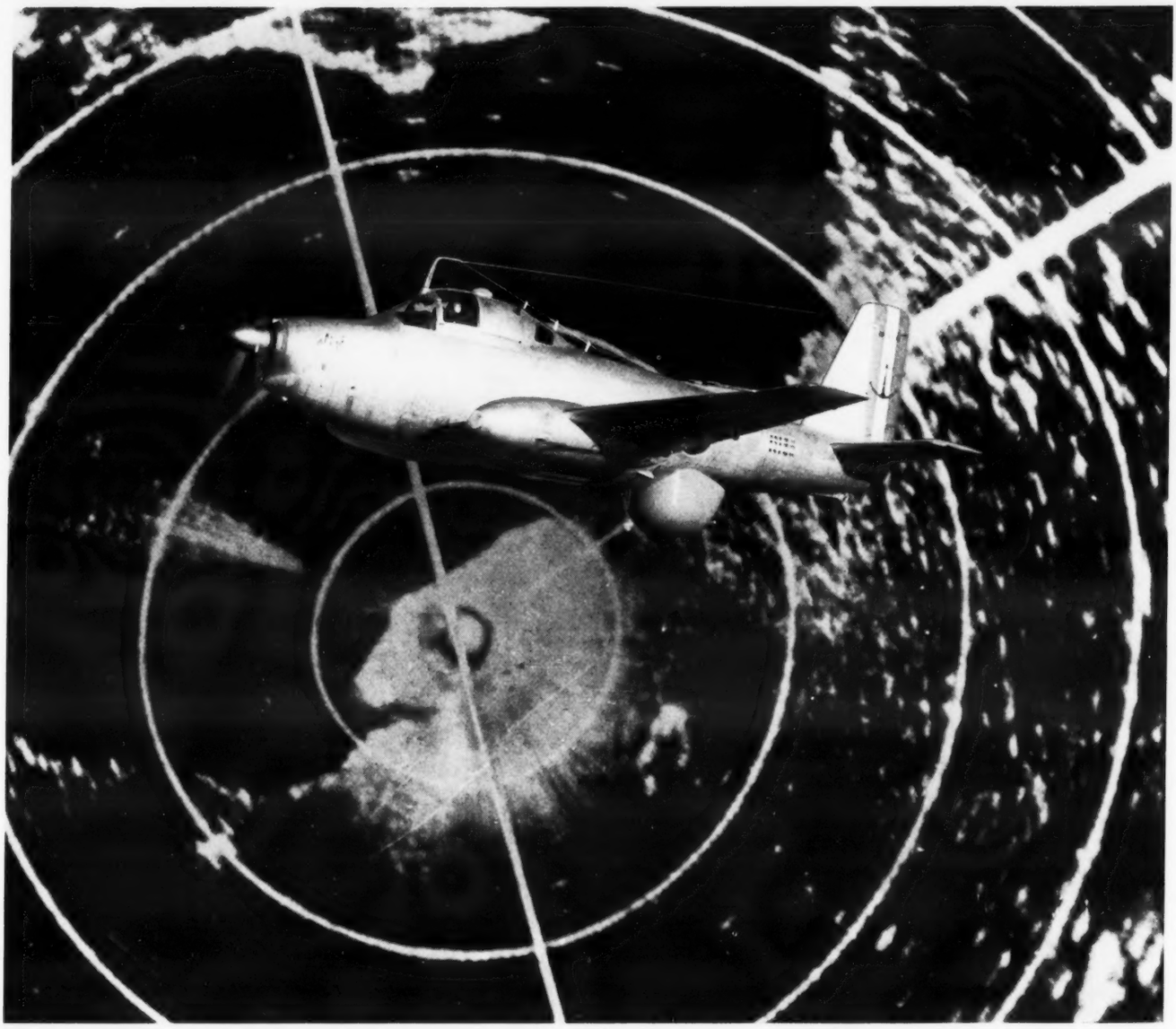

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Carrier-borne submarine search and attack three-seater. Ordered in quantity for the French Naval Air Arm to equip the aircraft carriers FOCH and CLEMENCEAU.

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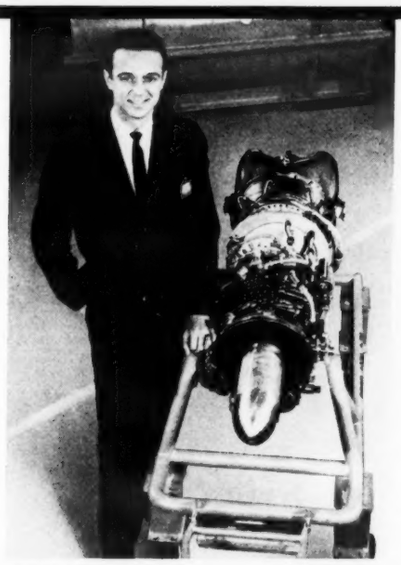
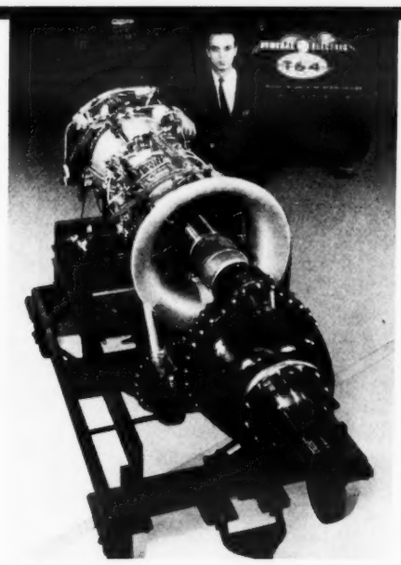
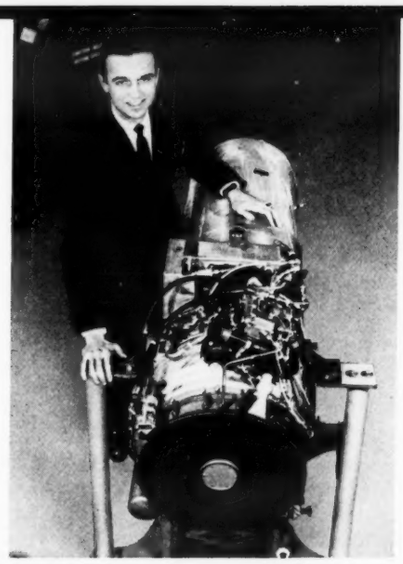


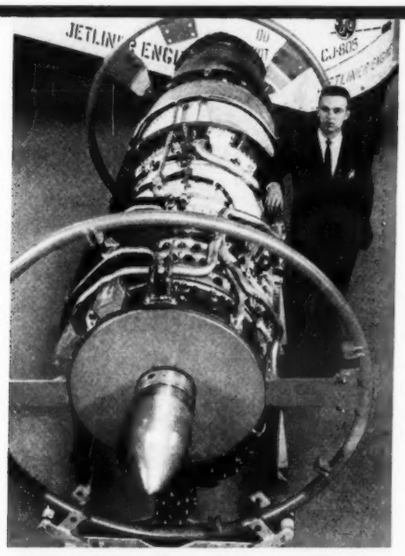
T58 G.E.'s T58, now in production, delivers more power per pound of engine, consumes less fuel per hp-hr than any other turboshaft flying today. Guaranteed at 1050 shp, 0.64 SFC, this 271-pound powerplant has proved itself during extensive flight operations and environmental testing. Now on test is the 1250 shp first-step growth version.



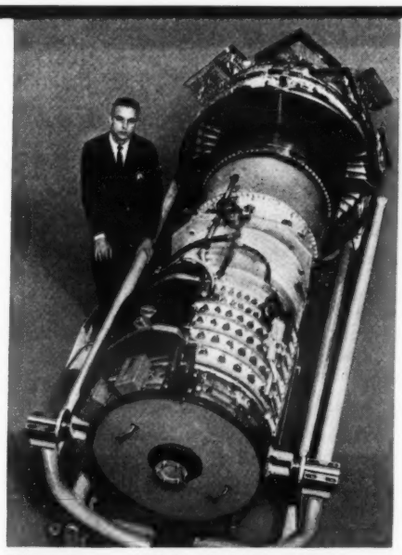
T64 G.E.'s T64 is a turboprop/turboshaft engine in the 2600 horsepower class. A compact, versatile power package, it can be used in either fixed-wing or rotary-wing aircraft, or as a power source for advanced aircraft applications. Both configurations of the T64 are on test and are confirming their exceptional performance characteristics.



J85 The powerful (2000-lb-thrust class), lightweight J85 turbojet introduces new levels of power and performance. Designed to provide dollar savings, performance advantages in missiles, drones, small and medium sized aircraft, the J85 is being flight tested in McDonnells' "Quail" decoy missile, North American's T-39 utility trainer, and Northrop's T-38 supersonic trainer.



CJ-805-3 G.E.'s commercial counterpart of the J79. Rated in the 10,000-lb-thrust class, it has a 4:1 thrust-to-weight ratio. Now being proved in extensive flight and factory test programs, the -3 will power the Convair 880 jetliners. G-E built reverser-suppressors produce optimum results with minimum losses.



TF35 and CJ-805-23 Designed for near-sonic transport aircraft, the TF35 combines the J79 gas generator with an aft-fan for higher thrust at lower SFC. Commercially designated the CJ-805-23, it will power the Convair 600 luxury jetliner.

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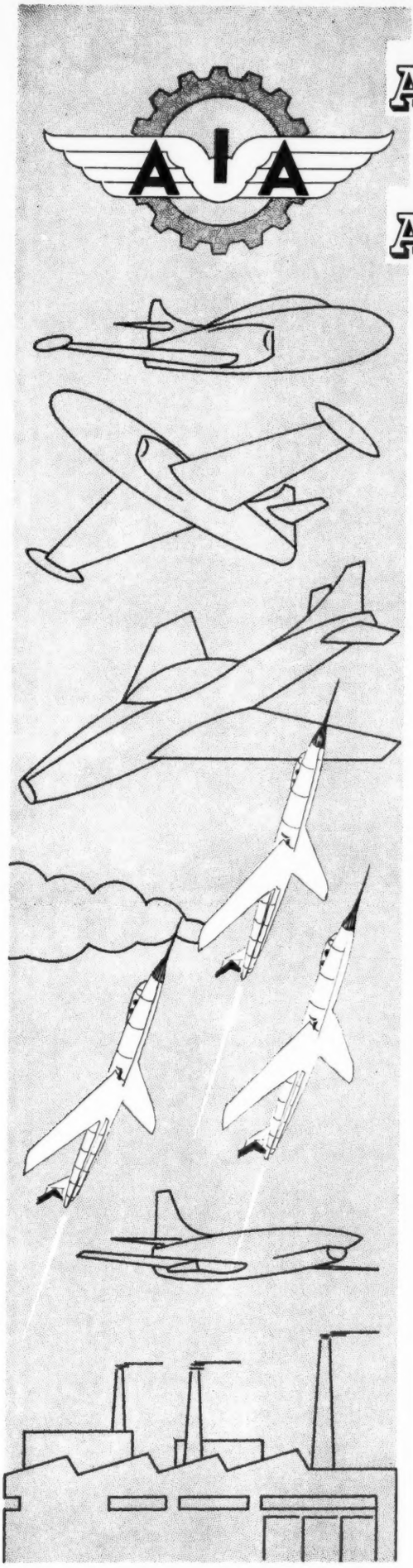

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6 MAJOR REASONS

why the '540' is the new challenger on short-to-medium routes!

1 DEFINITELY LOWER OPERATING COSTS

The standard 48-seat Canadair-Convair '540' offers **a direct operating cost of 1.4¢ per seat mile which comes down to 1.1¢ in the 58-seat configuration.** Over distances as short as 80 miles, its economy of operation matches even that of piston-engined aircraft.

2 GROWTH CAPACITY TO MEET GROWING ROUTE DENSITIES

The Canadair-Convair '540' has the built-in capability of growing with the increased traffic densities that are forecast for the years ahead. It can do this because its **seating capacity can be increased by 20%** from 48 to 58 **without weight or operating penalty.** All fuel for terminal-to-terminal operation could still be carried.

3 MATCHED-TO-TASK JET-PROP ENGINES

The Napier 3500 e.h.p. engines that power the Canadair-Convair '540' are **the only jet-props specifically designed for the particularly strenuous up-and-down life of short stage operations.** The sectionalized design of these powerful new engines make them singularly easy to service and maintain.

4 REDUCED EN-ROUTE GROUND TIME LOSSES

The Canadair-Convair '540' **eliminates numerous possible time delays at en-route stops:** passenger handling is expedited . . . time consuming engine warm-ups are unnecessary . . . as many as 6 route stops can be made without refuelling.

5 FASTER FLYING, QUICKER CLIMBING

Today's passengers want to **make time.** The Canadair-Convair '540' is **the fastest aircraft in its class,** flying at speeds up to 340 m.p.h. It's off the ground in a flash and takes only 6.4 minutes to climb to an operating level of 10,000 feet.

6 EXTRA CARGO SPACE FOR EXTRA PROFITS

The Canadair-Convair '540' has 402 cubic feet of easily accessible cargo space: enough for **two tons of additional payload** that can be carried with no operating penalty.

MOST IMPORTANT TO YOU: the Canadair-Convair '540' is a product of the combined experience and facilities of two of the world's great aircraft producers—Canadair Limited of Canada and Convair—both members of the General Dynamics family of companies.

THE CANADAIR-CONVAIR '540' WILL SOON TOUR WESTERN EUROPE

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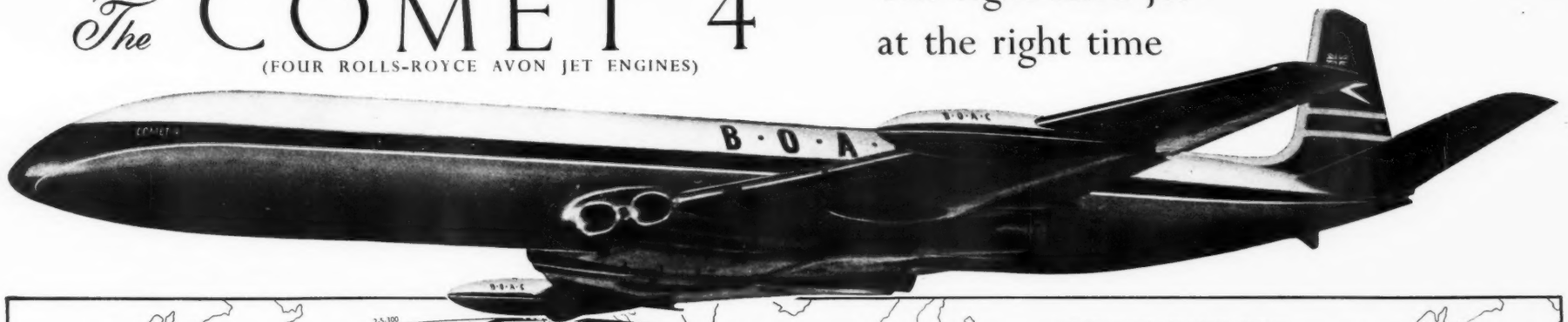

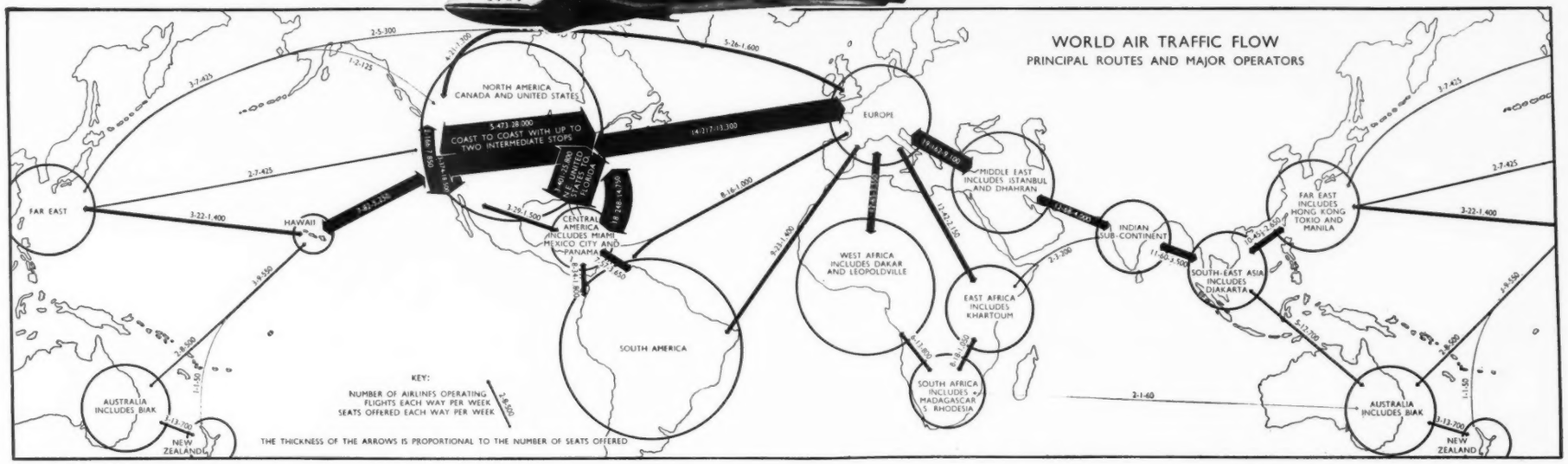

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The U.S. Airline Industry in 1958

"Air Transport Facts and Figures", 1959 Edition

The Air Transport Association of America would be doing the U.S. airlines no great service if it sounded paeans of joy in its annual report on 1958 or indulged in dollar and cents arithmetic to suggest that the air transport industry was earning big fortunes. But even allowing for certain customary cries of woe, the objective impression remains that the American carriers are not having an easy life at the moment. In 1957 they recorded total revenues of $2,100 million and a net profit of only $44 million, and although in 1958 the ratio of profit to revenues actually rose (roughly $53 million on sales of $2,200 million) net income was still only 2.4 cents per dollar of sales.

The financial obligations entered into by the industry for the renewal of the airline fleets have been amply discussed in these pages. Nevertheless it is interesting to add that as regards the value of capital investments the airline industry now ranks in second place among American business : An estimate of 1959 investments published by the U.S. Department of Commerce in March 1959 gave the following figures (in million dollars) : heavy industry $1,188, air transport $800, railroads $753, automobile industry $678, paper $608, non-ferrous metals $388.

Another well-known fact is that the strikes during 1958 were a serious burden on the airlines. With 880,000 working days lost, the loss in productivity was far above the average for the previous two years (696,910 days).

Finally, 1958 brought no appreciable lightening of the tax burden. Although the 3-percent tax on air freight shipments was repealed, there remained the 10-percent Federal transportation tax on passengers.

On the other hand, not much help could be obtained by raising revenues, as the CAB approved only a small rise in fares : in February 1958 airlines were permitted to increase fares generally by 4 percent and add a standard $1 to each ticket sold, and in October to eliminate the round trip discount of 5 percent and reduce the discount for family dependent travel from 50 percent to 33 1/3 percent.

☆

With obvious satisfaction the Air Transport Association notes that, despite these financial burdens and despite labour troubles, ton-mileage rose—though by only a small proportion—as compared with 1957, while other forms of transport recorded sharp losses.

Compared with the previous year, the number of passengers remained almost unchanged, at 49,075,000 as against 49,339,000 in 1957. On the other hand, the number of passengers carried by the railroads fell by 14 percent and by long-distance buses by 2 percent.

The insignificant fall in passenger numbers on the air services chiefly hit the domestic trunk operators, whereas regional traffic and foreign and overseas services showed increases. These trends are illustrated by the following figures :

	Revenue Passengers (in thousands)	
	1957	1958
Domestic Trunk Airlines	40,275	39,513
Local Service Airlines	3,949	4,265
(Hawaiian Islands, Alaska internal, Alaska-U.S.)	589	572
Helicopter Airlines	152	228
International and Overseas Airlines	4 065	4,182
Alaskan Airlines (trunk)	309	315
Total Scheduled Airline Industry	49,339	49,075

☆

Despite reduced passenger figures, revenue ton-miles carried showed a slight increase:

Available Service and Utilization

	Available Ton-Miles Flown (millions)	Revenue Ton-Miles Flown (millions)	Ton-Mile Load Factor (%)	Available Seat Flown Miles (millions)	Revenue Passenger Miles Flown (millions)	Passenger Load Factor (%)
1957	7,121.5	4,004.4	56.23	51,022.7	31,243.1	61.23
1958	7,265.7	4,074.7	56.08	53,069.6	31,481.9	59.32

☆

Finally, turning to the question of the airline industry's safety record, the Air Transport Association's annual report cites some highly illustrative figures : during the 1954-58 five-year period the scheduled airlines had an accident rate of only 0.38 fatalities per 100 million passenger-miles flown. This compares very favourably with the 1944-48 five-year period, when fatalities reached the figure of 2 per 100 million passenger-miles operated.

The late Whitley C. Collins, Northrop President.

Thomas V. Jones, the newly appointed Northrop President.

Thomas V. Jones succeeds W.C. Collins as Northrop President

Whitley C. Collins, President of the Northrop Corporation, died in Beverly Hills in the early morning of May 12th, 1959, following surgery for a circulatory ailment. Collins, who was 60, was originally a bank expert and made his first contact with the aircraft industry in 1929 when he joined Lockheed Airplane Company as Vice President and General Manager. Two years later he was instrumental in founding the Radioplane Company of Van Nuys, California, now a division of Northrop Corporation and the world's largest manufacturer of target drones. In 1954, he was elected President of the then Northrop Aircraft Inc., today the Northrop Corporation.

During the five years of his Presidency, Collins brought a skilled touch to an aspect of the company's activity which had not been one of its strong points in earlier years—cost control. For example, his strict attention to tight budgetary control over costs earnings per share rose from $3.28 in fiscal 1955 (to July 31st, 1956) to $3.62 in fiscal 1956 and $4.29 in 1957. For the period ending July 31st, 1959 the Northrop management anticipates a further advance. The company backlog of unfilled orders rose from $216 million in July 1957 to $242 million in July 1958, and since then has increased by a further $22 million.

In other words, the late President Collins leaves his successor, formerly a Northrop Senior Vice President Thomas V. Jones, a well organized and efficiently active company. Apart from this, the new 39-year-old President has himself contributed to the progress of the company during the recent years. An engineer and specialist in missile and space problems, Jones has been active in the aircraft industry for more than 18 years ; following several years with Douglas, he participated in the establishment of the Institute of Technology for Aeronautics for San Jose dos Campos after World War II ; he then joined the Rand Corporation.

Dr. Louis Ridenour †

Dr. Louis N. Ridenour, Lockheed Vice President, died suddenly in Washington at the age of 47. He was on a business journey, and died in a hotel room. Formerly head USAF scientist, Dr. Ridenour joined Lockheed Aircraft Corporation in 1955, and before taking his last position was Assistant General Manager and Chief Scientist of the Missiles and Space Division ; he was appointed a Vice President of the Corporation and Manager of the newly established Electronics and Avionics Division in March, 1959. Dr. Ridenour was also Chairman of NASA's Control, Guidance and Navigation Committee.

INTERNATIONAL MEETINGS AND CONFERENCES

June 8th-11th : American Rocket Society Semi-Annual Meeting and Astronautical Meeting. San Diego, Calif.

June 8th-12th : " Chemistry of Propellants " — AGARD Combustion and Propulsion Panel. Paris.

June 12th-21st : French Aircraft Industries Association, Paris International Air Show. Le Bourget Airport, Paris.

June 13th : Air Force Day across the nation with appropriate recognition of the 50th Anniversary Year. Canada.

June 14th-18th : Semi-Annual Meeting, American Society of Mechanical Engineers. St. Louis, Mo.

June 15th-17th : Annual General Meeting of the Canadian Aeronautical Institute. Ingonish, Nova Scotia.

June 15th-July 5th : 6th International Congress on Electronics, Nucleonics, Television, Radio and Cinematography. Rome.

June 16th : 12th Session of the ICAO General Assembly. San Diego, Calif. *

June 16th-18th : 41st Air Force-Aircraft Industry Conference : " Tactical Ground Support Equipment," sponsored by the USAF Directorate of Flight Safety Research. Los Angeles, Calif.

June 16th-19th : IAS National Summer Meeting. Los Angeles, Calif.

June 17th-21st : FAI Round-Europe Flight, organized by the Royal Netherlands Aero Club.

June 20th : Special Anniversary of Flight observations, including a static air display and air show. Sydney, Nova Scotia.

June 21st-26th : Summer Pacific General Meeting and Air Transportation Conference, American Institute of Electrical Engineers. Seattle, Wash.

June 21st-July 5th : 1959 German Soaring Contest, organized by the German Aero Club. Forchheim, Karlsruhe.

June 23rd-24th : Annual General Meeting of ADV. Brunswick.

June 23rd-25th : Ausschluss für Funkortung Congress : CW radar—advantages and disadvantages compared with pulse radar. Essen.

June 23rd-25th : Aviation Distributors and Manufacturers Association, 33rd Meeting. San Francisco, Calif.

June 24th-26th : 2nd National Symposium, Nuclear Industry Division, Instrument Society of America. Idaho Falls, Idaho.

June 26th-29th : 11th Air Tour of Sicily, organized by the Aero Club of Palermo and the Aero Club of Italy.

June 29th-July 1st : 3rd National Convention on Military Electronics. Washington, D.C.

June 30th-July 5th : Aero Club of Italy week. Rome and Venice.

July 1st-10th : U.S. National Soaring Competition. Elmira, N.Y.

July 4th-8th : All Woman Transcontinental Air Race from Lawrence, Mass. to Spokane, Wash.

July 5th : International flying, gliding and parachuting meet, organized by the Royal Aero Club of Belgium. Gosselies.

July 9th-11th : National Air Races 1959 (Championship Class Races and King's Cup) and British Lockheed International Aerobatic Trophy. Baginton, Coventry, England.

July 12th : Vancouver International Air Show. Vancouver Airport, B.C.

July 14th-15th : Airlines Electronic Engineering Committee. Los Angeles, Calif.

* To be reported on in the July issue.

New York Finance Notes

Ground Installations also Cost Money

BY SCOTT HERSHEY, NEW YORK

All of the money problems attendant upon the advent of the age of jet transportation are not concerned with the purchasing of new, expensive aircraft. The problems of handling the jets and their large passenger loads on arrival and on departure are a matter of increasing concern to the air transportation industry around the world. Larger airports, longer runways, noise depressers, more passenger and baggage facilities and better communications are a must. All of these cost money. And the money men are taking a careful look at requests for funds to make these improvements.

In the meantime, a United Nations study has come up with some recommendations which are receiving considerable attention and which will be discussed late in June by the International Civil Aviation Organization Assembly at meetings in San Diego, California. The U.N. study recommends that the nations of the world meet the demands of jet travel by dropping " political considerations "—a large order in itself—and band together to create international air centers to prepare for the new aircraft. Improvements to airports and the construction of new ones, better communications systems, a heavy program of personnel training, and more accurate upper-air weather observations are among the problems that might be investigated by such centers, the study suggested.

The report was prepared by a group of experts sponsored by ICAO. The survey found that improvement of airports and the extension of runways is progressing comparatively well throughout the world, but that in many areas the construction of new airports and major improvements will have to be speeded if progress is to keep pace with the development of jet aircraft. Present navigation and communications systems are slow and unreliable in some places, the study said, although most countries have undertaken programs to improve these facilities.

" Countries planning the creation of new traffic control systems or the modification of existing ones should consider the possible technical and economic benefits of establishing fewer and larger centers, possibly including international centers jointly operated and supported," the report said.

The panel of experts noted a well-known truth that " a shortage of money " is " one of the principal roots of deficiency in implementation of ICAO's plans " and suggested that a method of international financing and technical assistance be created to help solve the problem. " There are countries," the study said, " where necessary and expensive improvements of air navigation services are unlikely in the foreseeable future unless a continuing source of improved services can be found."

It is significant that Wall Street is taking more and more interest in airport financing, and the issues which have come to market in the past year and a half or more have been readily salable. There are very few major airports where some improvements are not either under way or are planned for the near future in order to accommodate the increasing traffic prompted by jet service.

*

Up to now, however, the high load factors reported by jet carriers have not been reflected on the books. American Airlines, for example, has announced that it has sold privately $30,000,000 in 5 percent notes due in 1996 and has issued $40,000,000 of subordinated debentures convertible into stock at $35 a share. The identity of the new creditors was withheld at their request, not the airline's. The company declined to state when the maturity date would be of the new convertible debentures.

The announcement came as somewhat of a surprise to some Wall Street and industry observers. American has not sold any securities publicly since 1946 when it placed $40,000,000 of 3½ percent convertible preferred stock and $40,000,000 of 3 percent debentures. Since then, it has sold privately, $75,000,000 of 4 percent notes due in 1996 and $60,000,000 in 4½ percent notes, also due in 1996.

The new borrowing will help in the acquisition of American's new jet equipment, but the company said only that the proceeds would be used for " general corporate purposes ". American had 8,107,454 shares of common stock outstanding as of March 31st. The new convertible debentures, if conversion rights are exercised by the purchasers, would increase the outstanding total by some 1,143,000 shares.

American reported a loss of $1,977,000 for the first quarter, exclusive of gains on property sales. There was a net gain of $1,129,000 from property sales which cut the total net loss to $848,000. This compared with a net profit of $1,635,000 for 1958 which included a gain of $570,000 from property sales. First quarter revenues dipped to $69,475,000 from $71,057,000 in the sames period the year previous.

American is not the only airline which has been tapping the money market, or is planning to do so. United Air Lines made a private placement of $39,600,000 of 4 percent debentures not long ago to complete a $120,000,000 credit arrangement established in 1955. And Pan American is paving the way for up to $50,000,000 of financing through the sale of convertible debentures. Pan Am's Board of Directors had not made a definite decision as to issuance of securities, but will put the matter up to its stockholders so they will be in a position to sell the debentures when ready. Stockholders have been assured they will have preemptive rights, so they would have first chance to subscribe to any offering of convertibles.

Long term debt of Pan American totaled $158,945,000 at the start of this year, and the company had agreements with banks covering credits for an additional $60,000,000 of borrowing. At the start of the year, the company had $160,000,000 of aircraft on order, of which $61,414,000 already had been paid for, with $65,000,000 due for payment in 1959 as " progress payments."

While a goodly proportion of the monies is being supplied to the airlines by lending institutions as straight debt, normal procedure requires an increase in owners' equity as the base on which a pyramid of loans can rest.

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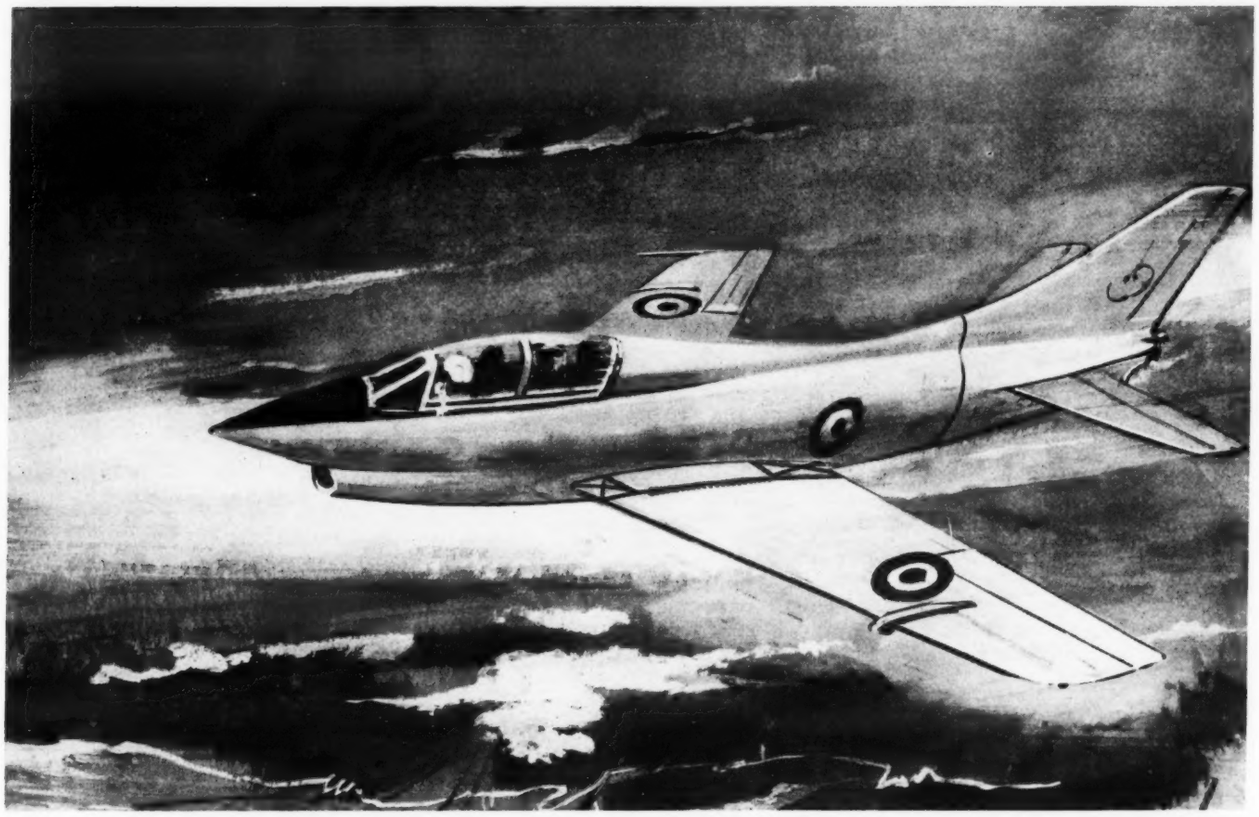

FIAT'S NEW G.91 T

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DEVELOPMENT AND PRODUCTION: H-3 "Kolibrie" helicopter, "Aviobridge" hydraulically operated telescopic passenger gangway.
DEVELOPMENT: AT-21 pulsejet powered pilotless target- and photo-reconnaissance drone.
CONVERSION AND OVERHAUL: Douglas DC-6 aircraft.
LICENCE CONSTRUCTION: Hawker Hunter Mk 4 and Mk 6.
CONTRACTORS TO: Royal Netherlands Navy, Royal Netherlands Airforce, U.S. Army Ordnance Industrial Center Europe, K.L.M. Royal Netherlands Airlines and various other civil airlines, Argentine Navy etc.

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Main Office: Papendrecht (Holland)

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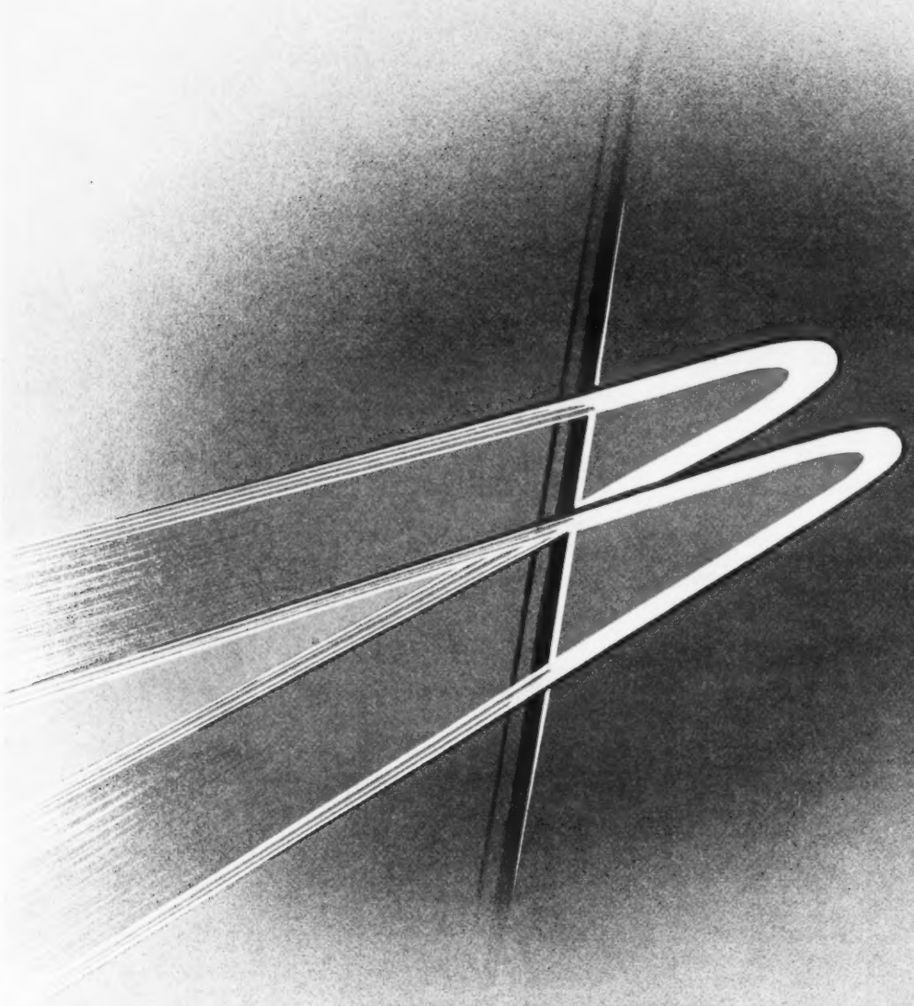

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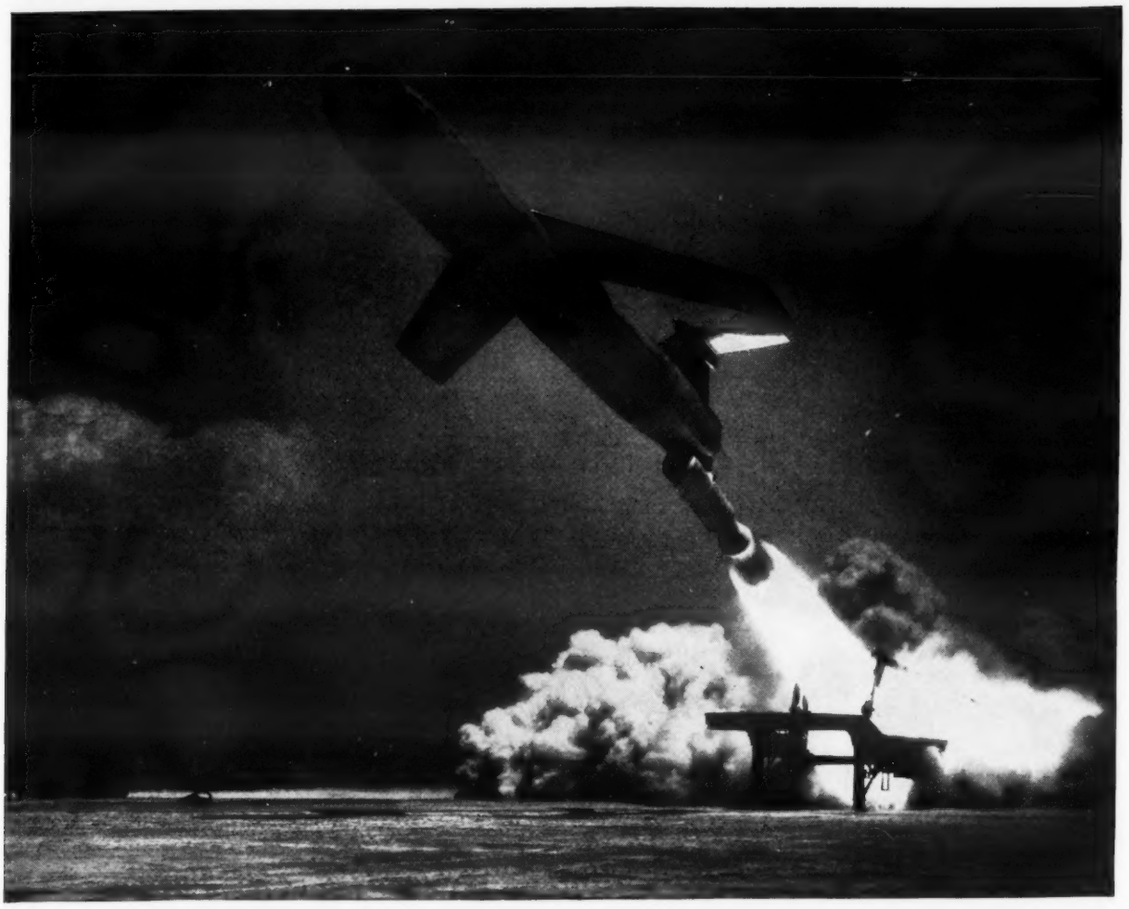

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AVAILABLE now for the defense arsenals of NATO members, the MACE is already in production. MACE-equipped U. S. Air Force squadrons are now in operation in Western Europe.

SEE THE MACE AT THE MARTIN EXHIBIT, 23rd Salon International De L'Aeronautique, at Le Bourget Airport, Paris, from June 12 to June 21. Indoor exhibit features three operating model displays showing MACE in action. Outdoor exhibit consists of actual operational MACE with launcher and transportation system.

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NORATLAS

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VICTOR

Vertol Aircraft Reports on

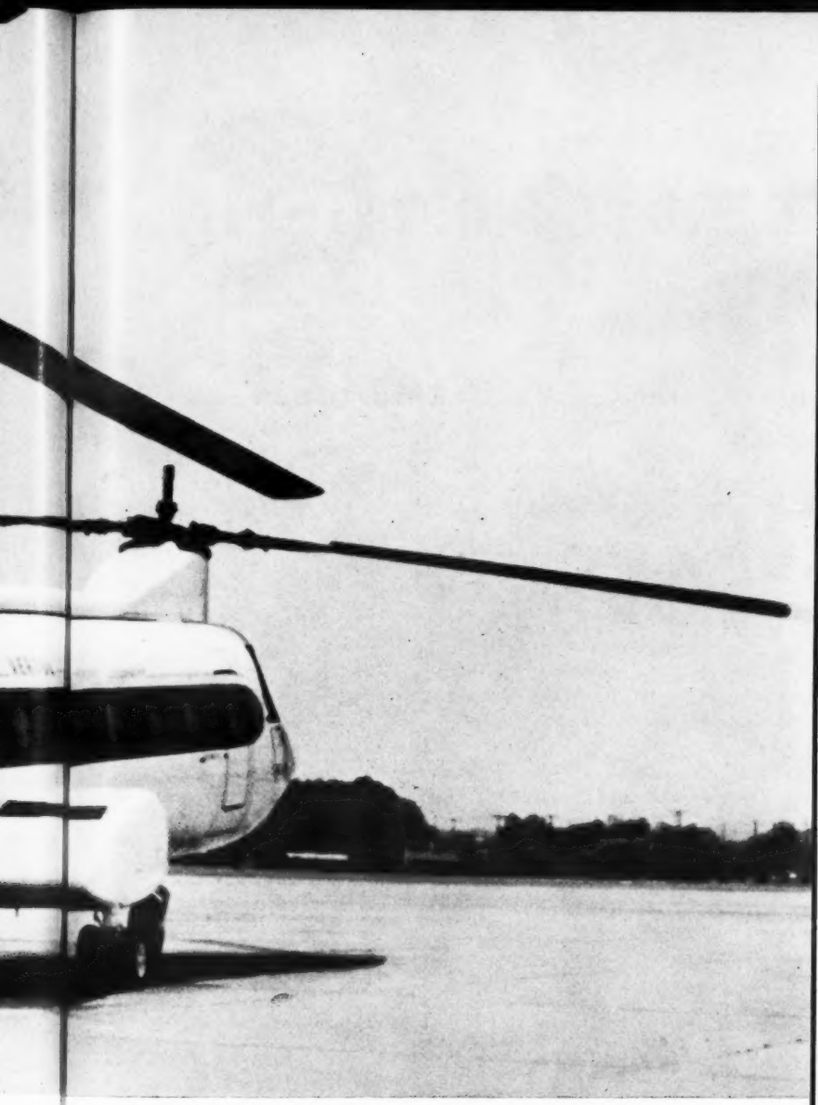
Tandem rotor center-of-gravity

Of the many superior advantages of the tandem rotor helicopter pioneered by Vertol, one of the most important is its unexcelled permissible center-of-gravity range. The tandem inherently supplies a great margin of longitudinal control in the direction it is most needed.

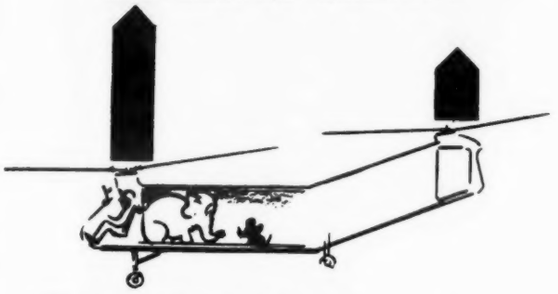
- The tandem rotor helicopter permits indiscriminate loading and freedom of movement for passengers while the aircraft is in flight.
- Minimum time is required for loading, since loading procedures can be established without continually checking and rechecking computations before flight.

The tandem's wide center-of-gravity permits passengers aboard New York Airways Vertol 44B to choose any seat.

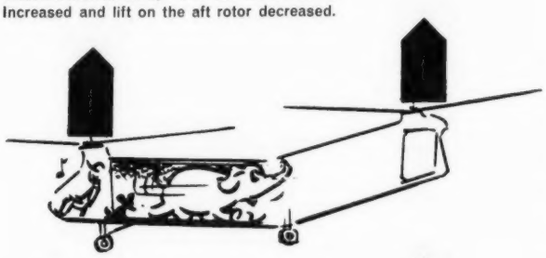
Unexcelled center-of-gravity range enables paratroops in the Vertol 107 to move toward the rear jump door on command.



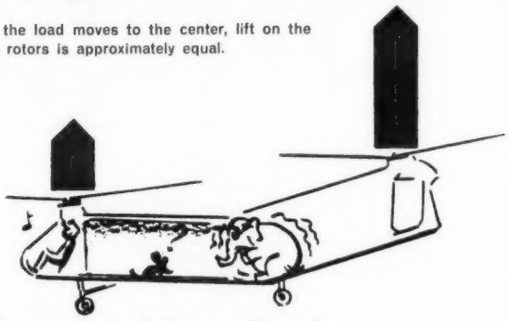
UNEXCELLED PERMISSIBLE CENTER-OF-GRAVITY



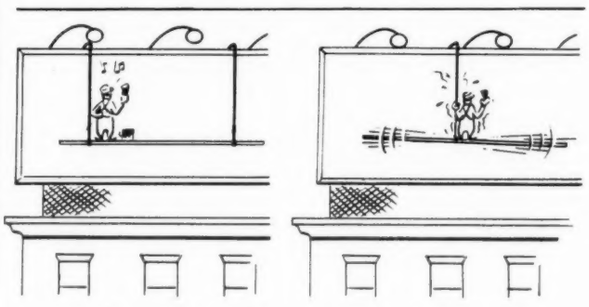
With the load forward, lift on the front rotor is Increased and lift on the aft rotor decreased.



As the load moves to the center, lift on the two rotors is approximately equal.



With the load aft, pilot increases lift on aft rotor, decreases it on forward rotor.



TANDEM ROTOR BALANCE SINGLE ROTOR BALANCE

In the tandem configuration, with its center-of-gravity superiority, a load can be placed within a wide permissible area, unlike the single rotor whose center-of-gravity range is substantially shorter.

superiority

Mock-up of an Army missile (above) is being loaded in cabin of Vertol YHC-1, first of a new generation of multi-turbine powered helicopters. The large center-of-gravity range in the tandem helicopter permits the elongated missile to be carried in the cabin and the aircraft flown with the rear ramp open.

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...MEANS BETTER WEAPONS FOR DEFENCE

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The know-how obtained by the three principal contractors guarantees the success of even more formidable defensive weapons in the future.

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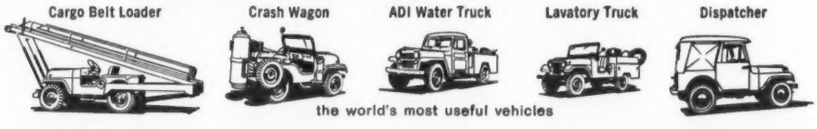

the world's most useful vehicles

world's FASTEST...

MISS JERRIE COBB, on April 13, 1959, at the World Congress of Flight, Las Vegas, Nevada, flew an Aero Commander 680E to a NEW WORLD SPEED RECORD for aircraft in its weight category, over a 2000 kilometer course. Now the fastest, Aero Commander had previously established world records for distance and altitude in 1957.

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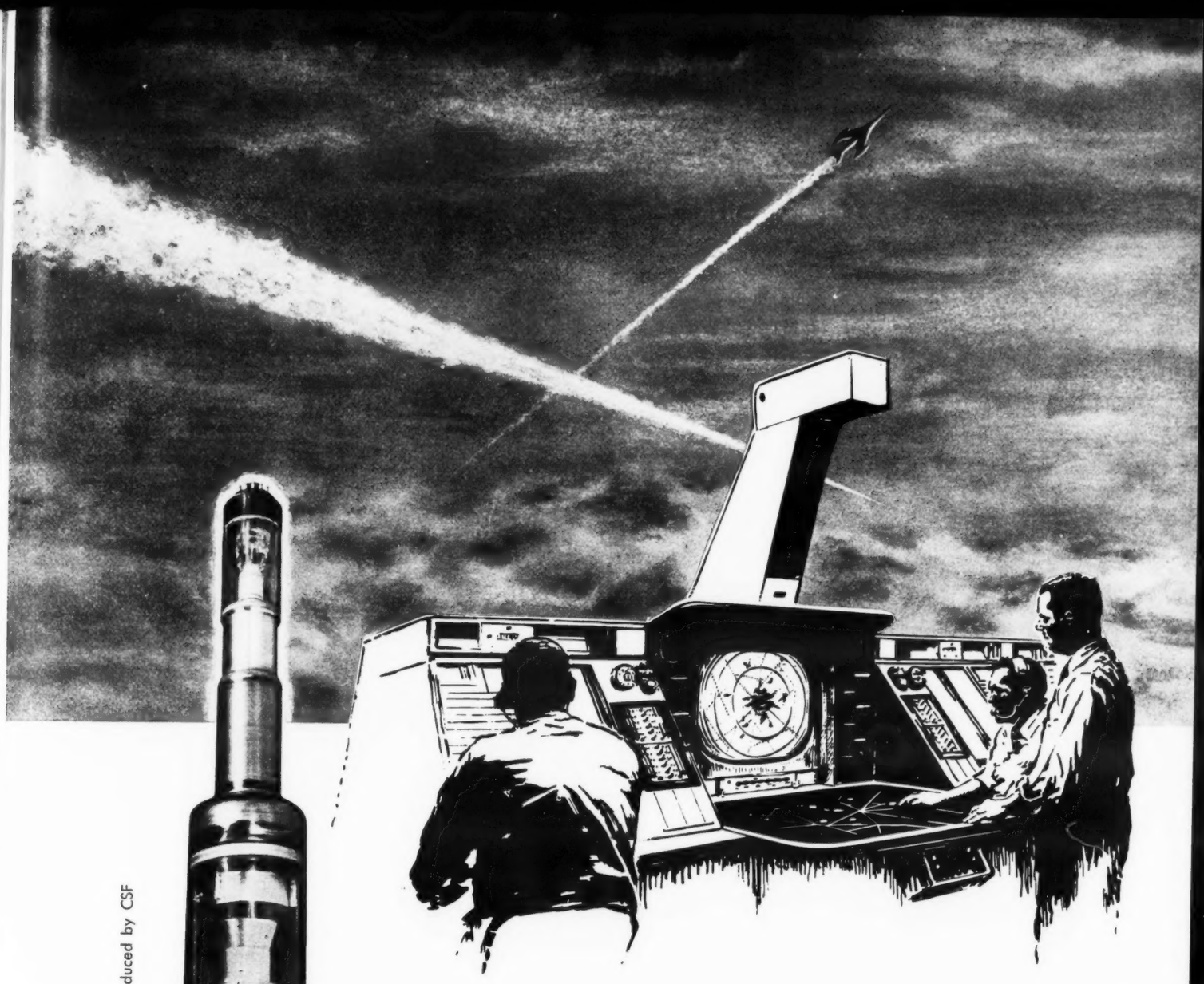
LOOK TO THE LEADER IN BUSINESS AIRCRAFT

AERO DESIGN & ENGINEERING CO • BETHANY, OKLAHOMA



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by making it possible to **superimpose** on the image various service symbols, aircraft identifications, geographical features . . .

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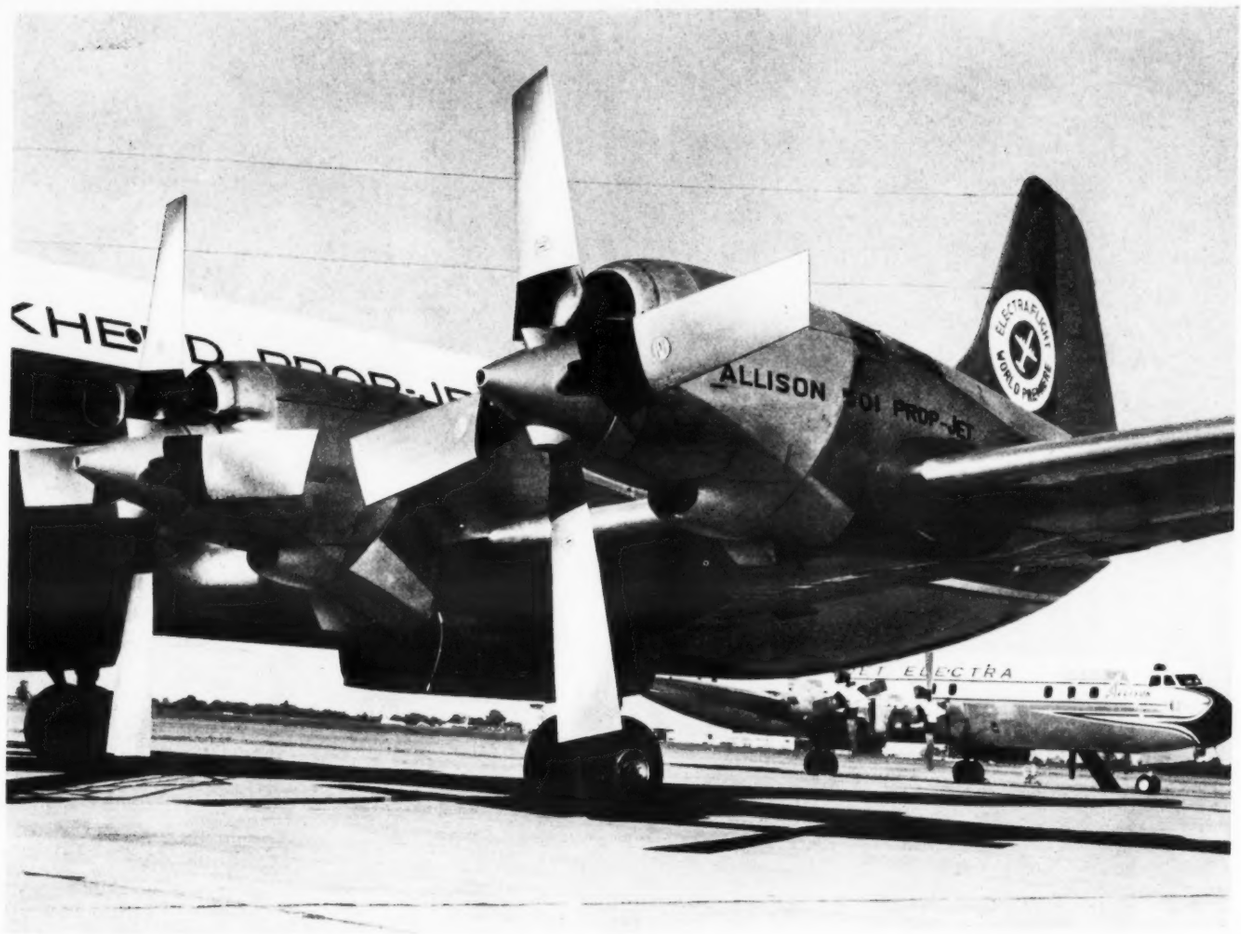

The Allison-powered Lockheed Electra is now in service or about to enter service for 13 of the world's airlines: Ansett/ANA, Cathay, KLM, Qantas, TEAL, Trans-Australia, American, Braniff, Eastern, National, Northwest, Pacific Southwest Airlines, and Western. Continuing high load factors indicate the flying public's enthusiastic acceptance of the 450 mile-per-hour aircraft.

The matched power team of Allison 501-D13 engines and Aeroproducts Turbo-Propellers gives the Electra outstanding take-off, climb, cruise and landing performance.

Operators find the Electra to be a profitable aircraft because of its economical operation and excellent passenger acceptance as demonstrated by high load factors. Pilots appreciate the power of these dependable constant-speed engines, the fast response of the Aeroproducts Turbo-Propellers, and the engine's inherent characteristics for providing rapid power corrections during the landing approach... all features that contribute to the Electra's capability of operating today from 1300 of the world's airports!

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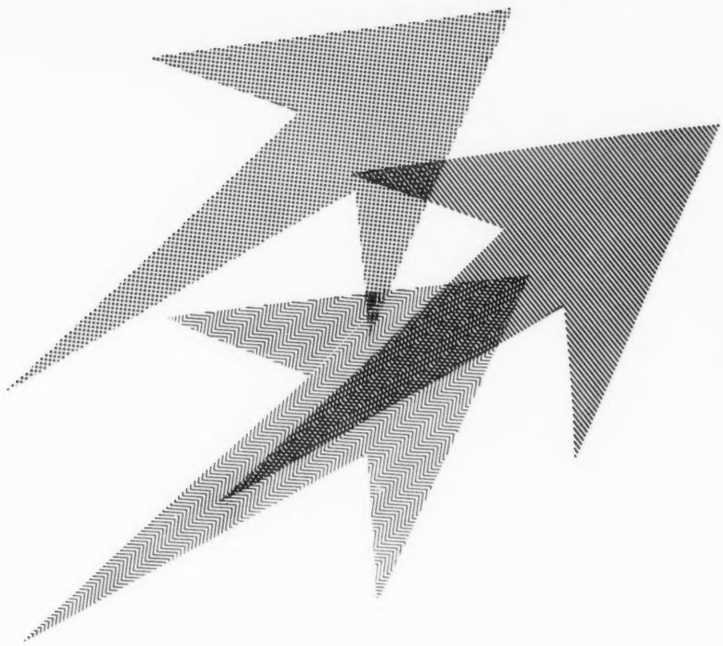
THE FRENCH AIRCRAFT INDUSTRY

will present
its latest prototypes
and production aircraft

at the
23rd Salon International
de l'Aéronautique

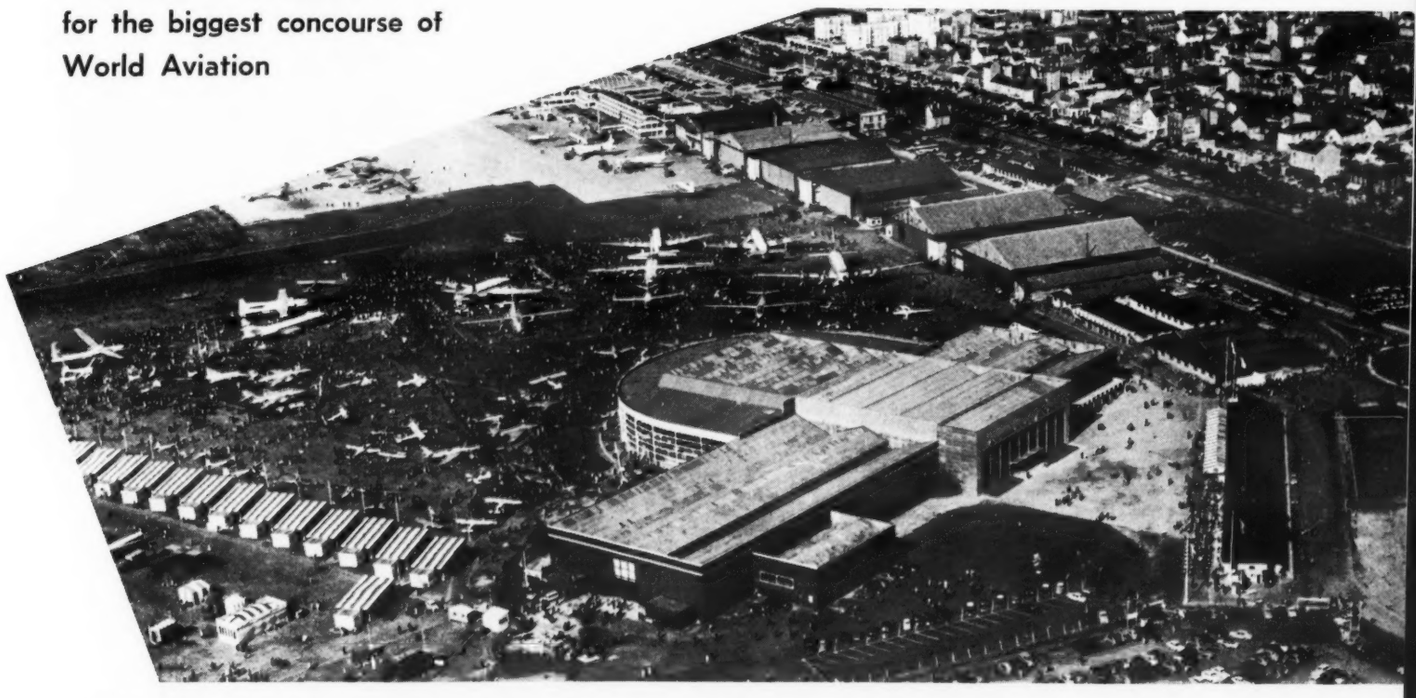


which is celebrating its

Fiftieth Anniversary
1909-1959

To be held at Le Bourget, Paris
from June 12th to 21st, 1959

12 Nations represented
200 Aircraft assembled
for the biggest concourse of
World Aviation



UNION SYNDICALE DES INDUSTRIES AÉRONAUTIQUES - PARIS

FOR ITS FUTURE DEVELOPMENT POSSIBILITIES...

The ENGLISH ELECTRIC Lightning is one of the most advanced fighters in the world. Even so it is clear that the basic design has further great potential development—not only in performance, but also in adaptation to other operational roles. This built-in stretch offers economies of production and operation, as well as ensuring that, tactically speaking, it can be adapted to meet any situation which may arise

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The Fifth Republic's First Air Show

Mid-May 1959

On my last visit to Paris a few weeks ago I called in on one of the heads of the French aircraft industry and found him just signing the formal invitation to the President to open the Paris Show. Henri Desbruères, President of SNECMA and chairman of the organizing committee for the 23rd Paris Air Show, sincerely hopes that he will have the honour of escorting General Charles de Gaulle on a tour of the stands, which this time represent a total of 14 nations. In the past it has so often happened that the President of the Republic has been prevented from accomplishing this traditional duty because he was in the throes of a Government crisis . . . However, times have changed in France.

The Paris International Air Show is of course in a class by itself . . . As is probably appreciated by the ambitious organizers of the "World Congress of Flight", who apparently thought that expensive publicity, the attraction of Las Vegas, Nevada, with its night clubs and casinos, an exhibition of mainly American equipment and a banquet could rival the Paris Air Show. The present issue contains an unbiased account of the Las Vegas Congress, which admittedly attracted several thousand visitors but can scarcely be said to have provided a picture of *world* aviation. Elsewhere, the organizers of the barely airborne German aircraft industry also attempted to give their Hanover Air Show—also reported on in this issue—an international flavour. But they too found that it was not so easy. The annual SBAC Display at Farnborough and the biannual Paris Air Show are events which cannot be ignored. Comparisons with other events show that it takes years of experience to achieve the full-scale participation of the aviation world.

And if the French President does "take the salute" on June 12th, 1959, his heart may well be justified in beating a little faster: not only all the Western countries, but also the most important members of the Eastern bloc will be there. This is not merely a French Salon, or even a NATO show; this time it is a real showcase for the world's aviation products.

*

The present issue is introduced by Georges Février, who has taken care of *Interavia's* interests in France for a quarter century and who has earned a high reputation in his country both for himself and for *Interavia*. Février sounds a patriotic and a critical note, and asks: ". . . What is the French aircraft industry's present situation? What are its hopes, its projects and its future? Abandoning for once *Interavia's* traditional neutrality, I propose to associate myself with it in this examination . . ."

Why conceal the fact? A year ago the French industry was in a serious dilemma. The indecision of its planners and the constant changes in government had brought it almost to the edge of the abyss. Today it once again has a programme. What this programme is, in broad outline, is described by a far-sighted military writer, General Pierre M. Gallois, later in the issue.

Harry Tennant, Douglas Cornell and Norman Lynn, *Interavia's* American correspondents, have contributed to the review of the United States' impressive exhibits in Paris. Derek Wood, Manager of Interavia (U.K.) Ltd., who normally writes in something of a lyrical vein, apologized for writing what is virtually a catalogue of the British aircraft industry; he had been unable to do otherwise, he explained, as the industry was appearing practically in full strength at Le Bourget. Canada and Italy, Belgium and Holland, Spain and Czechoslovakia, West Germany and the Soviet Union, Poland and Sweden, even Austria and perhaps Switzerland . . . all will be there. All feel the urge to visit Paris once at any rate!

*

The reader will find that the present issue differs somewhat from what he is used to in *Interavia*. Inevitably it has turned into a catalogue, a *guide to the 23rd Paris Air Show*. But so many of our readers live on the other side of the world—a fact which gives us no small satisfaction—and cannot all be expected to make the journey to Paris. For those who stay away the issue will be instructive in many respects, for not only the articles and pictures, but also many of the advertisements contain valuable information. With its 267 exhibitors, including roughly 160 French stands, the Paris Salon will present all the latest developments.

There was a time, in the good old pre-war days, when the former head of the Fokker works smilingly presented visitors to his stand with a "Guide to Paris" which not only described museums, theatres, architectural wonders, restaurants and the like, but also provided foreign guests with fairly exhaustive information on the joys of Paris night life. This was a thoughtful attention and fitted well into an age of leisure which was at that time to be found even in aviation. Since then life has become more earnest. From modest beginnings there has grown up an industry which today is venturing out towards the exploration of space.

On this note, we present readers with our own "Guide to Paris", the *Interavia* Guide to the Paris Salon. EEH

Programme for the 23rd Salon de l'Aéronautique

June 11th—21st, Le Bourget, Paris

Thursday, June 11th: Preview, reserved for representatives of the French and foreign press.

Friday, June 12th: Official Opening Ceremony.

Saturday, June 13th: Postage Stamp Day; first issue of a special series of postage stamps to commemorate the many test pilots who have lost their lives in the service of aviation.

Sunday, June 14th: Air Transport Day; demonstration of the international airline companies' newest equipment.

Monday, June 15th: Air Sports Day; demonstration of over 100 types of sports and touring aircraft, aerobatics, and parachute jumping.

Tuesday, June 16th: Electronics Day; technical lectures and demonstrations.

Wednesday, June 17th: Aviation and Space Medicine Day; space exhibition—satellites and research vehicles.

Thursday, June 18th: Helicopter Day; static and airborne displays of various helicopters; passenger flights between the individual Paris airports.

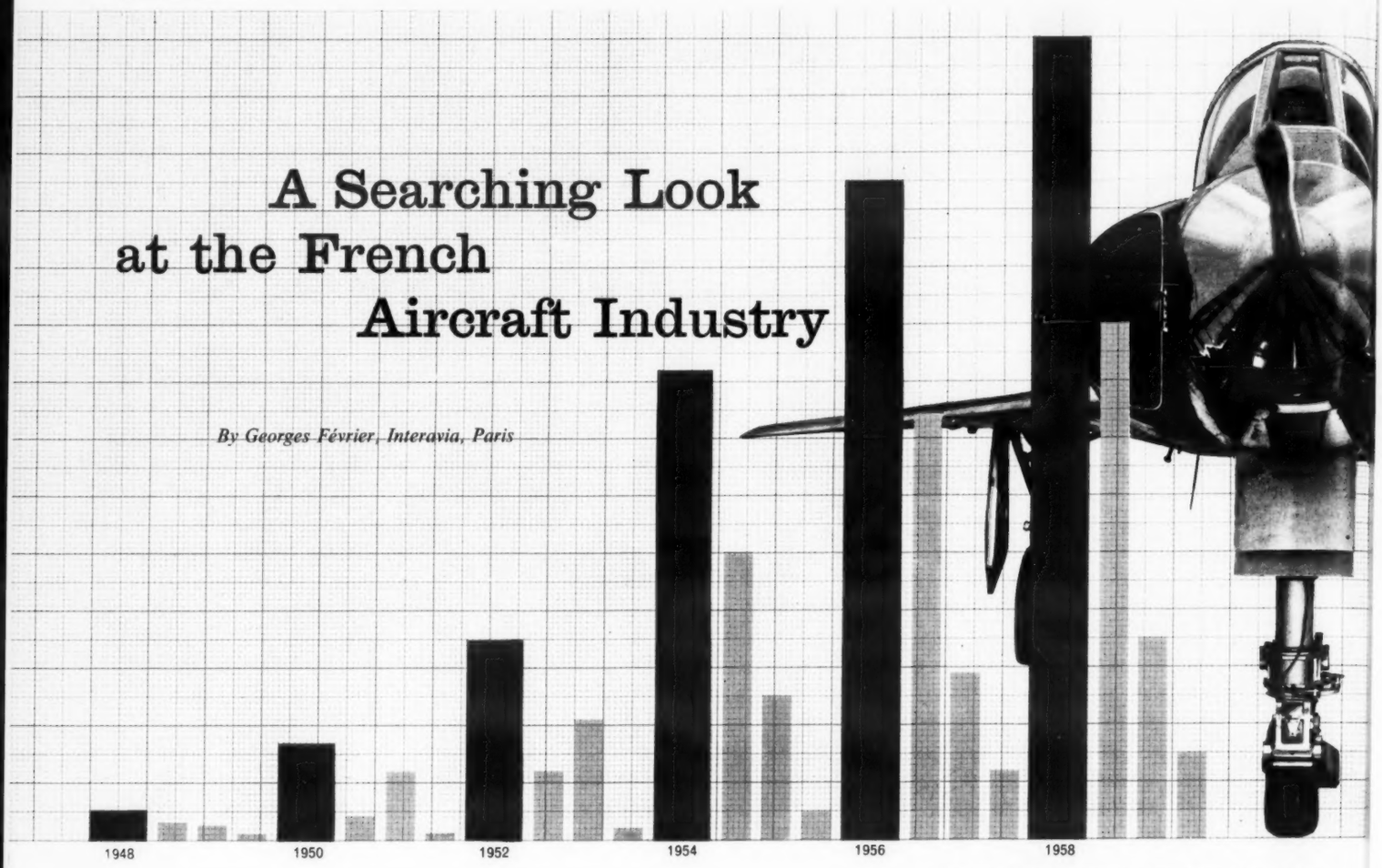
Friday, June 19th: Official Delegates Day; reserved for official French and foreign delegations and personalities.

Saturday, June 20th: International Flying Display; reserved for guests of the French Aircraft Industries Association, official delegates, technicians and the press. Luncheon for about 4,000 guests.

Sunday, June 21st: International Flying Day; open to the public. Part of this show will be televised over Eurovision.

A Searching Look at the French Aircraft Industry

By Georges Février, Interavia, Paris



Exports of French aeronautical equipment show a rising trend: in 1948 the value of airframes, engines and accessories exported amounted to 340 million French francs: by 1958 this figure had passed the 8,000-million mark.

Every two years the Paris Salon provides an excellent opportunity for surveying the international aeronautical scene, comparing technical advances and achievements, and noting the progress made since the previous Show. For the French aircraft industry, which generously offers its hospitality to its foreign rivals, it is also the occasion for a searching examination of its own affairs. Just where is it heading? What is its present situation? What are its hopes, its projects and its future? Abandoning for once *Interavia's* traditional neutrality, I propose to associate myself with it in this examination. In plain language!

There is little point now in recalling the severe handicap—the war and the occupation—which the French aviation world has had to overcome. The successive exhibitions and flying displays at Le Bourget have shown that this handicap has long been mastered, first as regards prototypes and soon afterwards in the matter of production.

The tangible proof of this achievement is the constantly growing value of its exports, covering nearly a dozen different aircraft types: *Ouragan* and *Mystère IV A, Noratlas, Magister, Broussard, Paris, Caravelle, Djinn, Alouette,* SS.10, SS.11, etc. . . .

If we add to this list the SM 52, the *Vautour,* the Breguet *Deux Ponts* and *Taon,* the *Trident, Griffon* and others we might be tempted to conclude that the aircraft industry was in a most enviable situation in this early part of 1959. And when we look further and see the wide variety of new designs coming along in their turn—the *Mystère III, Etendard IV,* Breguet *Alizé* and 1150 (NATO naval patrol aircraft), *Super Broussard,* MS *Epervier,* Sud Aviation *Fonceur* or Dassault *Spirale,* the SE.3200 helicopter, the MATRA, Nord-Aviation and Sud Aviation missiles, and—last but not least—the very new *Mirage IV* bomber, the industry's future would appear to be assured for many years to come.

But financial stringencies and, to put it plainly, a certain lack of precision in planning by the Staff and the Defence Ministry's Technical and Industrial Directorate have introduced disturbing elements into production plans. And it is being found difficult to organize a smooth transition from the production lines now being phased out to the new lines.

With the cutbacks and stretch-outs which have been made, *Super Mystère B.2* production will finish at the end of the year, that of the *Vautour B* in September, and of the *Vautour N* in April 1960. The *Noratlas* and *Magister* will also run out at the end of 1959, and the *Paris* and *Broussard* in the early months of 1960. Yet the *Mirage III* and *Etendard IV,* which were to have been the follow-on types, have barely gone into production, and the twin-turboprop overseas model (SE.117 or MD 415) has not even got so far.

Thus, despite the fact that the *Magister* and *Noratlas* will probably be "prolonged", it is unfortunately clear that the nationalized industry will have to undertake a reorganization—as Hispano Suiza has already done—and will inevitably have to reduce its labour force. Such measures will become increasingly unavoidable since the decision in favour of missiles has been taken—Engineer General Louis Bonte, Technical and Industrial Director at the Air Ministry, has announced publicly that the *Mirage III* and *IV* will be the last piloted interceptor and bomber.

Regrets . . .

Regret, of course, is in itself always a negative emotion. Yet some useful purpose can perhaps be served by listing objects of regret if valid lessons for the future can be drawn from them.

Perhaps Hispano Suiza could have been asked to manufacture the *Avons* for the *Caravelle,* for which it holds a licence, rather than spending

precious foreign currency on buying them abroad. Perhaps it would have been possible to be a little less . . . rigid in the talks with Germany on the subject of the *Mirage III*. The production of this interceptor on a joint basis would have marked the birth of a real European industry.

Perhaps it would have been possible not to abandon the *Trident*, which had barely scratched its development potential, and could have been developed into a pilotless interceptor . . . Perhaps it would have been possible to order a few derivatives of the *Griffon*, whose combination jet/ramjet engine – the only one of its kind in the world – might have become the ideal propulsion system for future supersonic airliners.

Perhaps Breguet could have been permitted to push on with the *Taon*, the second-generation light strike fighter, since the third, VTOL, generation is much further off than had been thought at NATO headquarters . . .

. . . and hopes

Despite lost opportunities, despite the difficulties encountered in launching follow-on types into production, the French aircraft industry still has some good cards to play, as an examination of the hands held by the various companies will readily reveal.

Sud Aviation, for example, has not only the *Caravelle* (and perhaps the SE.117), the *Djinn* and the *Alouette*, but also the three-turbine SE.3200 helicopter, which with its derivatives—and Charles Marchetti has some extremely interesting projects in his drawer—represents a machine without parallel anywhere on the world market.

With its SS.10 and SS.11 anti-tank missiles and their successors—still on the secret list—Nord-Aviation can be sure of export contracts for a long time to come. Then it also has the medium transport project in collaboration with the German industry and, above all, the advanced models of the outstanding ramjet which has proved so successful in the *Griffon*.

SNECMA, the third State company, is to build the *Atar 9* for the *Mirage III*. Unfortunately it has had to abandon development work on the all-steel jet, for lack of funds, but is to manufacture under licence the jets for the *Mirage IV*, which will probably be Pratt & Whitney J75s.

Dassault's immediate future presents virtually no problems: orders are in hand for the *Etendard IV*, *Mirage III* and *IV*, and there may perhaps be possibilities for the *Spirale* and *Communauté* twin-turboprop models.

Breguet, who has good reason to hope for export orders for the 1050 *Alizé* anti-submarine aircraft, is also to produce the NATO naval patrol aircraft. It also has another major trump card, the 941 STOL design.

Max Holste, whose *Astazou*-powered *Broussard* is experiencing a new lease of life, can also count on its *Super Broussard*, with two Turboméca *Bastans*.

As for Potez, whose *Magister* will continue to be the standard jet trainer for a long time to come, this company is thinking of a supersonic "second phase" trainer. It may also be that Henry Potez has not forgotten that he used to build transport aircraft too . . .

As the future trend is inexorably towards concentration of effort – and of funds! – on a limited number of types, the other companies have little to look forward to but sub-contracts. And it is unlikely that they will be able to avoid merging, which offers their only chance of survival.

These "other companies" of course do not include Turboméca, who is manufacturing the *Astazou, Bastan, Artouste, Turmo, Marboré*, etc., or Hispano Suiza, who produces the undercarriage for the *Caravelle*, or again Messier, who has an enviable order book for equipment for the Fiat G.91, *Mirage III* and *IV*—to mention only these three aircraft.

On the equipment side, too, mergers will be inevitable. This solution has already been chosen by Ducellier-Bendix-Air Equipement, and others will follow. However, certain companies, such as SFENA or Labinal, still seem to be well armed, thanks to their original designs.

Missiles

But, as I have already said, the switch-over to missiles has been decided upon. Engineer General Louis Bonte has made it clear that France will build a tactical ballistic missile and a strategic surface-to-surface ballistic missile (SSBS) with a range of 2,000 miles. These are long-term projects, in which the electronic industry will play a very big part.

In the air-to-air missile field, MATRA and Nord Aviation are producing the weapons for the *Mirage III*. When it comes to surface-to-air missiles (which are fundamentally the responsibility of the Directorate of Weapons Development and Production, rather than the Technical and Industrial Directorate), it unfortunately looks as if certain very promising missiles designed by Nord-Aviation, Sud Aviation and MATRA will be dropped.

While on the subject of missiles, it would be unforgivable to ignore SEPR, whose rocket engines and solid-propellant rockets are certainly the most advanced of any in Continental Europe,

Aircraft in production at Générale Aéronautique Marcel Dassault's Bordeaux-Mérignac plant include the *Super Mystère SMB.2* single-seat interceptor. By the end of the year the SMB.2, however, is scheduled to be replaced on the assembly line by the *Mirage III* supersonic fighter.

Top: Prototype of the Dassault *Mirage IV* supersonic bomber with two SNECMA *Atar 9* jets plus reheat; thrust approx. 13,200 lb. each; gross weight of the two-seater, which has been designed to the SAST (Système d'Armes Stratégiques Pilotés = Piloted Strategic Weapons System) concept, is 25 to 26 tons. Dassault is meanwhile working on a considerably heavier operational version (approx. 50 tons gross weight) of the *Mirage IV*, and plans to set up a line for a pre-production batch. The question of a powerplant for the new type has not yet been settled.

Centre: Dassault *Etendard IV M* carrier-borne fighter and low level strike aircraft with SNECMA *Atar 8* jet of 9,680 lb. thrust. A pre-production batch is under construction, and a production contract for a preliminary 50 aircraft has been awarded.

Below: Dassault MD.415 *Communauté* with two Turboméca *Bastan* turboprops (take-off power twice 750 h.p. plus 165 lb. residual thrust).

or the big electronic companies, such as CSF, Thomson Houston, LMT, etc. who will always play a considerable part in the design and production of radar equipment, weapons systems, guidance systems and missiles themselves. Compagnie Française Thomson Houston, for example, is the technical coordinator of the European group (Ateliers de Constructions Electriques de Charleroi, Telefunken, Finmeccanica, Philips and Thomson Houston) which is to manufacture the *Hawk* missiles to equip 22 Western European battalions.

The Aircraft Production Bill

Like so many other branches of French activity, the aircraft industry has seriously suffered from the "blow hot—blow cold" behaviour of the Ministry of Finance. It is now essential that it be given a degree of stability and that its activity should cease to be entirely dependent on the annual budget. In short, it should be able to work to a long-term programme. Such a programme has already been incorporated in a bill covering a period of five years, which is expected to give the State companies the means to work on a rational and sustained basis. By the time these lines appear in print, the Bill should have been laid before Parliament.

May a Frenchman who is deeply attached to his country's aircraft industry be permitted to hope that it will be passed.

. . . and kept to!

The Aircraft Production Bill

The production programmes for the period of five years covered by the Aircraft Production Bill are expected to be:

MILITARY

Air Force: Continued production of Fouga *Magister*, Nord 2500 *Noratlas*, Dassault *Mirage III*. Impending production of *Mirage IV* and twin-turboprops for overseas use (Sud Aviation SE 117 or Dassault MD 415).

Further ahead, a medium freighter (16,000 lb. payload at 1,200 miles) and light tactical support VTOL aircraft.

Navy: Dassault *Etendard IV M* and Bréguet 1150 (Naval reconnaissance aircraft).

For the three services: the Sud Aviation SE 3200 helicopter.

Missiles: Design and development of a tactical and a strategic ballistic missile, the latter with a range of 2,000 miles.

CIVIL PROGRAMME

Development of advanced *Caravelle* models, Breguet 941 and Max Holste *Super Broussard*.

EXPORT MARKET

Breguet 1050 *Alizé*, Dassault *Etendard IV M*, Fouga *Magister*, Nord 2500 *Noratlas*, Dassault *Mirage III*.

The Breguet hangar at Biarritz-Parme, with the last two Br. 765 *Sahara* transports. The 765 in the foreground has been experimentally fitted with auxiliary wing-tip tanks (to increase range to roughly 2,500 miles). Assembly of the *Alizé* anti-submarine aircraft (picture below) is now being phased in here.

Tour de France Aéronautique

By E. Baur, Interavia Geneva

Bordeaux, junction of sea, river and land transport routes, on the left bank of the Garonne and situated in the midst of the Bordeaux wine country... Biarritz, one of France's most elegant summer resorts... Toulouse, essentially an industrial city...

These three cities in the extreme southwest of France, however, are associated not only with wines, fashionable promenades or Basque cooking. Besides their traditional claims to fame, they have in recent years witnessed an astonishing rebirth of the aircraft industry, due in large measure to the far-reaching decentralization of the major manufacturers. Sufficient reason for abandoning old habits for once, and beginning the present report with the Bay of Biscay instead of with Paris.

Super Mystère, Mirage and Etendard

My first visit was paid to the plant of *Générale Aéronautique Marcel Dassault* at Bordeaux-Mérignac airfield. Dassault employs some 3,000 staff and workers in the Bordeaux region. It was here that the earlier MD.315 *Flamant* small transport and its different variants were manufactured; this plant, too, was responsible for production of the *Ouragan* and *Mystère IIC* and *IVA* interceptors. Today there are *Super Mystère SMB.2* single-seat interceptors on the assembly line, but within the near future the scene in the Bordeaux shops is due to change... the *Super Mystère* is to give way to the *Mirage III* supersonic fighter. At the moment a pre-production batch of ten of these aircraft is being built at Dassault's development plant at St-Cloud, near Paris, and it was only recently that the third *Mirage III* of this batch began flight testing. The last aircraft of the ten is scheduled for delivery in September 1959, and the first true production model roughly a year later.

Bordeaux is also working on a pre-production batch of the *Etendard IVM* carrier-borne fighter and low-level strike aircraft, of which—under present contracts—a total of fifty is to be produced for the French Naval Air Arm.

View of the Breguet production shops at Biarritz-Anglet.

Communauté and Spirale

Paul Deplante, Technical Manager of the Dassault Bordeaux group, and his design engineer Paul Chassagne surveyed the just-completed prototype of the MD.415 *Communauté* multipurpose turbine-powered aircraft with justifiable pride. A good half dozen different versions—for lightweight transport, communications, training etc. duties—are offered.

The purely military MD.410 *Spirale* for the observation and ground support role (six Nord SS.10/SS.11 guided missiles plus two cannon in the sides of the fuselage) is 90 percent identical with the MD.415 in structure and is also on the

A Beech D-18S which has been converted by SFERMA to Turboméca *Bastan* turboprops and Ratier-Figeac three-blade v.p. propellers. The first *Bastan-Beech* has already been delivered, and a second is now undergoing conversion. With its gross weight of 9,810 lb., this aircraft has a take-off distance of 920 ft.; rate of climb roughly 1,970 f.p.m.; cruising speed 230 knots.

Bordeaux programme. Both *Communauté* and Spirale form part of a strongly supported French production programme, to whose specifications Sud Aviation's SE.117 and SE.118 were also designed.

SFERMA—the aircraft overhaul specialists

Friendly and neighbourly relations are maintained between the Dassault plant and the maintenance and overhaul shops of *Société Française d'Entretien et de Réparation de Matériel Aéronautique* (SFERMA), whose installations practically border on Dassault's at Bordeaux-Mérignac. My first reaction on arriving at SFERMA's premises was one of surprise, which I openly expressed to the two managers, Alphonse and Robert Pinet (father and son). I had expected a relatively small repair shop; what met my eyes were highly modern hangars and maintenance plant covering an area of roughly 387,000 sq.ft. Some 1,100 skilled workers are here engaged on the overhaul and conversion of the most varied aircraft types, from the T-6 trainer to the four-engine Douglas DC-6.

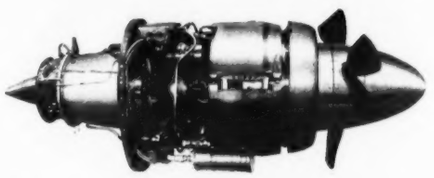
SFERMA is a subsidiary of Sud Aviation; in addition the airline TAI and the turbine engine manufacturers Société Turboméca are also represented on the Board. It is already quite some time since SFERMA began converting small executive and multi-purpose aircraft to turbine power, for example fitting the Beech D-18S with Turboméca *Bastan* turboprops. At present negotiations are under way with the American companies of Cessna and Aero Design & Engineering Corporation (for the Aero Commander).

Breguet at Anglet and Parme

Monsieur Laporte, manager of the "Relais de Parme" airport restaurant, is convinced that the number of "technical landings" made at "his" airport is directly connected with the variety of his menu and the qualities of his wine cellar. And the staff of the Breguet plant at Biarritz and Parme appear to share his view.

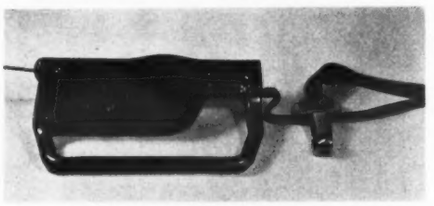
Despite these tempting surroundings, Manager J. Leloup and Chief Pilot Y. Brunaud remained matter-of-fact and made no attempt to conceal the fact that cutback in the order for the Breguet 765 *Sahara* transport to only four aircraft left behind a tangible void. Nevertheless, the assembly lines are being taken up to an increasing extent by the *Alizé* three-seat anti-submarine aircraft (with Rolls-Royce *Dart*). Not only Anglet and Parme are involved in the *Alizé* programme, but also Breguet's Toulouse plant, as well as Morane-Saulnier, of Tarbes (tail unit) and Hispano Suiza, of Bois-Colombes (undercarriage). Radar and other electronic equipment is supplied by CSF and Auxilec, among others. As matters stand at the moment, a total of 75 *Alizés* is to be built, and Breguet hopes that the planned monthly output of five aircraft will be achieved before the end of the year. This type is also considered to have good export prospects.

Meanwhile Breguet has also designed the *Br.1150 naval patrol and anti-submarine aircraft* (two Rolls-Royce *Tynes*) for NATO, and work on the *Br.940 STOL prototype* is so far advanced that civil and military orders for its pre-production model, the *Breguet 941* (four de Havilland *Gnomes*), can be expected soon.



Turboméca's *Bastan* was the first French turboprop engine to be certificated to ICAO standards. Take-off power is 750 h.p. plus 165 lb. residual thrust. The *Bastan* is already projected for half a dozen aircraft types, including the Dassault MD.410/415, Sud Aviation SE.117/118, Morane-Saulnier MS.1500 and Max Holste *Super Broussard*.

The EFA Type 30 chrono-barometric release mechanism, which is in production at Etudes et Fabrications Aéronautiques and can be used with practically all parachute models now in service. Also an EFA parachute equipment for airborne troops, consisting of an extremely space-saving back-type parachute and an auxiliary parachute.



A call at Bordes and Tarbes

From Biarritz I travelled to Pau, centre of the Department of Basses-Pyrénées, where I found the mountains veiled in grey cloud. The object of this trip was a visit to *Turboméca* at Bordes, where the internationally known *Marboré II*, *Artouste* and *Palouste* engines—to mention only these three—are built under the management of J. Szydlowski. Of late the production programme has also included the promising *Bastan* and *Astazou* turboprops. Two *Bastans* are fitted in the Beech 18 as modified by SFERMA. In addition, this engine has been chosen for the Dassault MD.410/415 and SE.117/118 civil and military types.

The electrical, machinery and textile industries, not to mention the aircraft industry, are rapidly changing Tarbes from a sleepy cathedral town into a busy industrial city. It is here that *Morane-Saulnier* is producing its twin-jet MS.760 *Paris*, for export as well as for the French forces. Licence agreements have been signed with Argentina and with the Beech company in the United States, and the first MS.760s manufactured in Argentina have already been taken over by the Argentine Air Force. Needless to say, the other Morane-Saulnier plants also have their share in *Paris* production, as they have in the intensive development and testing work which is in progress on the MS.1500 *Epervier* two-seat multi-purpose and police aircraft (Turboméca *Bastan*).

Full steam ahead at Toulouse

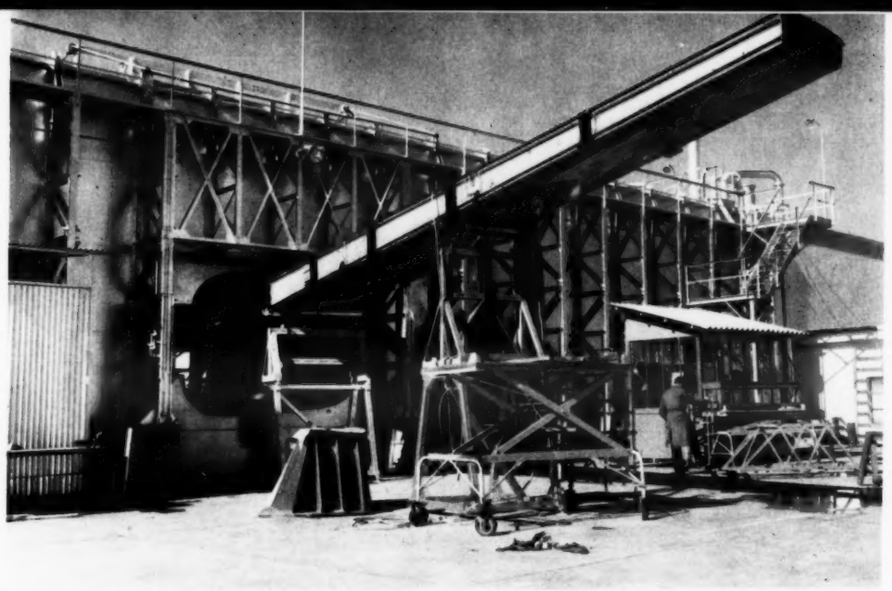
Not only the workers at Sud Aviation's Saint-Martin and Saint-Eloi plants, on the outskirts of Toulouse, but the whole local population is proud of the *Caravelle*, and every Toulouse schoolboy can tell at a glance whether the *Caravelle* just coming in to land is a Version I or a Version III.

During my visit to Toulouse I had a lively discussion with Paul Ducassé, Assistant Chief

Designer at Sud Aviation's Blagnac Design Office, and Monsieur Gaebelé, of the Liaison and Sales Service, on future plans for this aircraft up to the *Super Caravelle* model.

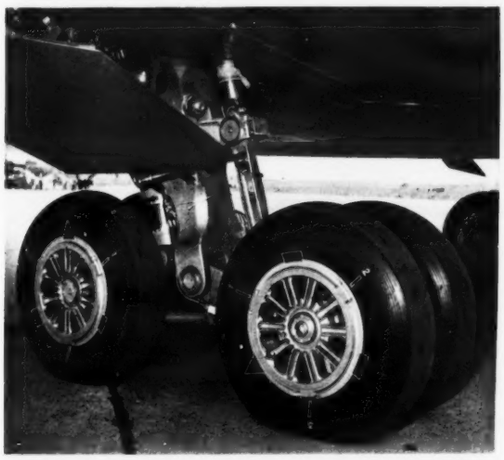
The draft Aircraft Industry Bill, discussed at a press conference a few weeks ago by Engineer General Louis Bonte, Technical and Industrial Director, attaches particular importance to the later models of the *Caravelle*. At the present time there is talk of four different versions, of which two are already known, namely the *Caravelle I* (gross weight 95,900 lb.; *Avon RA.29s* of 10,500 lb. thrust each) and *Caravelle III* (99,200 lb. gross weight; 11,400 lb. thrust per engine). The next development stage will be the VI version, with a gross weight of 103,600 lb. and engines with a thrust of 12,500 lb. each. Finally, a VII version, with 110,200 lb. gross weight and 14,000-lb. thrust engines, is planned for the end of 1962. Version I can be converted by airlines into Version III without major modifications, and every effort is being made to ensure that the Version III can be converted into the Version VI with equal ease.

Some hundred French plants are implicated directly or indirectly in production of the *Caravelle*. For example, Sud Aviation's Marseilles-Marignane works are responsible for manufacturing forward fuselage sections, while the same company's Bouguenais and St-Nazaire plants provide the wing units. Structural assembly of the rear fuselage, complete with the load-bearing structure for the tail unit and engines, is the responsibility of Société Latécoère, while Breguet's Anglet factory fits the technical and commercial installations. Landing flaps are built by Les Forges de Boissière, of St-Florent-sur-Cher, and Hispano Suiza takes care of undercarriage manufacture. Finally, Fiat's Turin plant produces the engine nacelles.



By the end of March 1959 a *Caravelle* airframe had undergone aging tests at Etablissement Aéronautique de Toulouse simulating more than 10,000 flights, each of three hours' duration. Picture shows the EAT water tank containing the *Caravelle* pressure cabin and wing torsion box.

The Hispano Suiza main undercarriage and nose-wheel unit for the *Caravelle*.



The *Caravelle* in production at Saint-Martin.

Morane-Saulnier MD.1500 *Epervier* for ground support and observation duties.

Apart from the *Caravelle* and the work on helicopters which is concentrated at La Courneuve and Le Bourget, near Paris, Sud Aviation is also completing production of the *Vautour* twin-engine fighter-bomber, which will be phased out at the end of the year. Meanwhile, prospects of receiving orders for the twin-engine SE.117 *Fonceur* and its civil version, the SE.118 *Diplomate*, are described as good.

Mention must also be made of Sud Aviation's activities in the missile field. The company is known to be working on the development of a medium-range ballistic weapon as well as on another surface-to-surface missile, the *Casseur*. The latter has reportedly been designed to meet overall European needs.

Magister and Esquif

On the other side of the runway at Toulouse-Blagnac airfield lies one of the *Potez Air Fouga* plants. Here the CM.170-R *Magister* trainer (Turboméca *Marboré II*) is being turned out at the rate of roughly six aircraft per month. As is known, this trainer has not only found favour with the French Air Force, but Potez Air Fouga has also been able to export a respectable number, as well as to sell production rights to a number of countries. In this connection West Germany first comes to mind, then Finland, whose Air Force recently took over a batch of eight *Magisters*, while the Valmet factory has already got licence production under way. Israel is another country which has taken production rights, while Belgium has so far bought 45 finished aircraft, and Austria six.

J. M. Rève, Manager of Fouga's Blagnac plant, next showed me the *Esquif*, a naval version of the *Magister*, for which a first order for 30 has been placed by the French Naval Air Arm.

Rotorcraft at La Courneuve

At the beginning of April the order book for the *Sud Aviation Alouette II* turbine-powered helicopter ran to over 460, more than fifty percent of them for export. And helicopters of the *Alouette* and *Djinn* types are already in service in 24 countries on five continents . . . Charles Marchetti, who runs the La Courneuve plant, need certainly not feel ashamed of the sales results achieved so far.

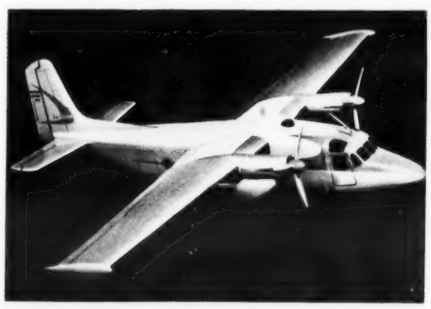
The new *Alouette III* version just announced, with 700 h.p. Turboméca *Artouste IIIB*, has accommodation for seven persons or can, in the military model, carry eight combat-equipped men.

Meanwhile, testing of the *SE.3200* heavy helicopter, a first prototype of which is to be demonstrated at the Paris Show, is nearing completion. A second prototype is in final assembly. In its present form, fitted with three Turboméca *Turmo IIIB* turbines of 800 h.p. each, the SE.3200 has a gross weight of 16,530/17,640 lb. and a cruising speed of at least 110 knots. Fuel is carried in two outboard tanks, which can be jettisoned if required; provision is also made for in-flight refuelling.

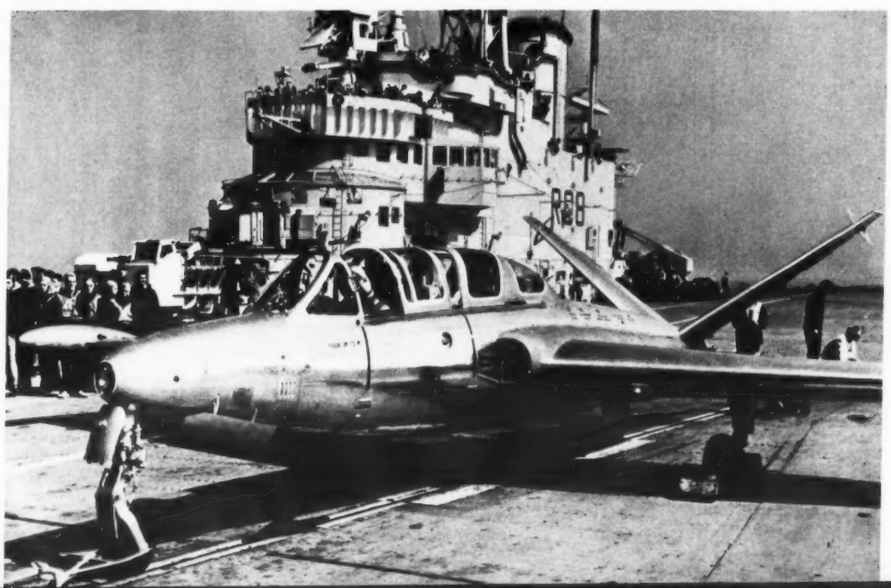
Parachutes, ejection seats and undercarriages

My original plan was to leave discussion of the many new products of the French accessories industry until after the Paris Show, but owing to my imperfect acquaintance with the Paris street plan, I found myself in Clichy on my way back from La Courneuve. Here the firm of *Etudes et Fabrications Aéronautiques* (EFA), headed by René Tauty and Marcel Pravaz, produces all the parachutes required by the Air Force, the Army's airborne units, etc.

Of particular interest here, is a new chrono-barometric release mechanism, which can be fitted to all parachute models now in service. The parachute is automatically opened either at a predetermined altitude (with the aid of an aneroid capsule) or—if below this altitude—after two seconds (with the aid of a clockwork mechanism). Parachutes with this device have recently been ordered by the Belgian Air Force. Another interesting EFA product is a parachute equipment for airborne troops, consisting in principle of a back-type parachute and a manually operated chest-type auxiliary parachute.



Model of the Max Holste MH.260 *Super Broussard* for 20 to 23 passengers. Projected powerplant consists of two Turboméca *Bastan* turboprops, though a version with Lycoming T53s is also planned (designation MH.280). At present a prototype of the *Super Broussard* (MH.250) is undergoing tests, with Pratt & Whitney R-1340 piston engines.



The *Esquif* two-seat Naval trainer; Potez Air Fouga is building a first batch of thirty.

Next came a brief call on *Hispano Suiza* at Bois-Colombes, whose undercarriage division has been scoring some undeniable successes. Hispano undercarriages are used in the *Caravelle*, the *Alizé* anti-submarine aircraft and the *Vautour*. Alongside these efforts, work is continuing in the engine division (e.g., overhaul of the Marboré jets for the CM.170-R). Moreover, a nuclear research division has recently been established, and

2 IN ONE

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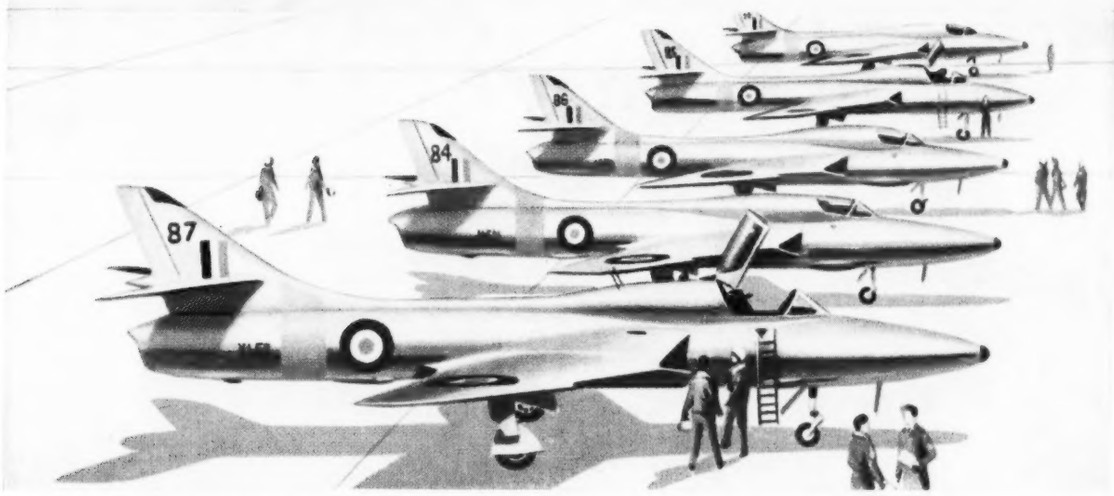
IS BOTH TRAINER AND COMBAT AIRCRAFT

The Hawker Hunter Two-Seater, benefiting from extensive development, makes the ideal Operational or Advanced Trainer. It combines fighter qualities with simplicity and ease of handling.
With one or two guns, it can be used operationally as well as for training. Such flexibility makes the Hunter Two-Seater an economic and attractive proposition for any air force.
Hunters are in service with no fewer than a dozen air forces.



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THE FIRST commercial international flight on February 8, 1919 in a "Goliath" aircraft carrying eleven passengers between Paris and London made by Lignes Farman, the earliest of the companies that later became known as Air France, was a far cry from the service of what is now "the world's largest airline." This year, Air France will fly the first of its new giant Boeing 707 Intercontinental jets for long-carrier service on its world-wide network totaling 192,000 miles on five continents. Quietly and smoothly these new Air France Boeing 707 jets will fly New York to Paris in little more than six hours, New York to Mexico City in less than four hours and Paris to Tokyo in twenty hours and forty minutes. To safeguard these jets and their passengers, all Air France Boeing 707 Intercontinental jets will be serviced with Skydrol fire-resistant hydraulic fluids.

SKYDROL is the only fire-resistant hydraulic fluid approved by the CAA. Skydrol outlasts and outperforms conventional fluids, providing higher lubricity for longer hydraulic system component life in all types of modern aircraft.

SINCE the introduction of Skydrol by Monsanto ten years ago, this fluid has performed for more than eight million flight hours without a single instance of fires from hydraulic leaks either in the air or on the ground. Produced exclusively by Monsanto Chemical Company, Skydrol fire-resistant hydraulic fluids are the standard of safety for both propeller-driven and jet aircraft.

SKYDROL fluids are available at principal airports around the world through the marketing affiliates of Esso Export Corporation, Mobil Overseas Oil Company and Shell Oil Company. A new 24 page technical booklet giving data on the properties and use of Skydrol fire-resistant hydraulic fluids can be obtained by writing to Monsanto Chemical Company, Overseas Division, Aviation Fluids Department, St. Louis 66, Missouri, U.S.A.

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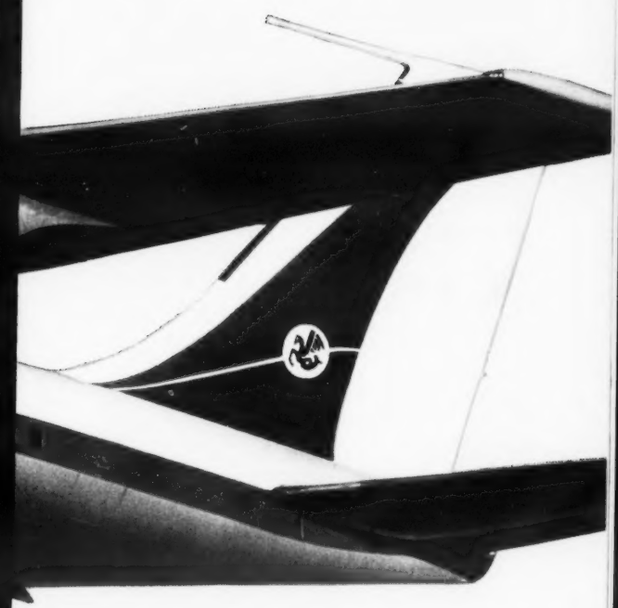
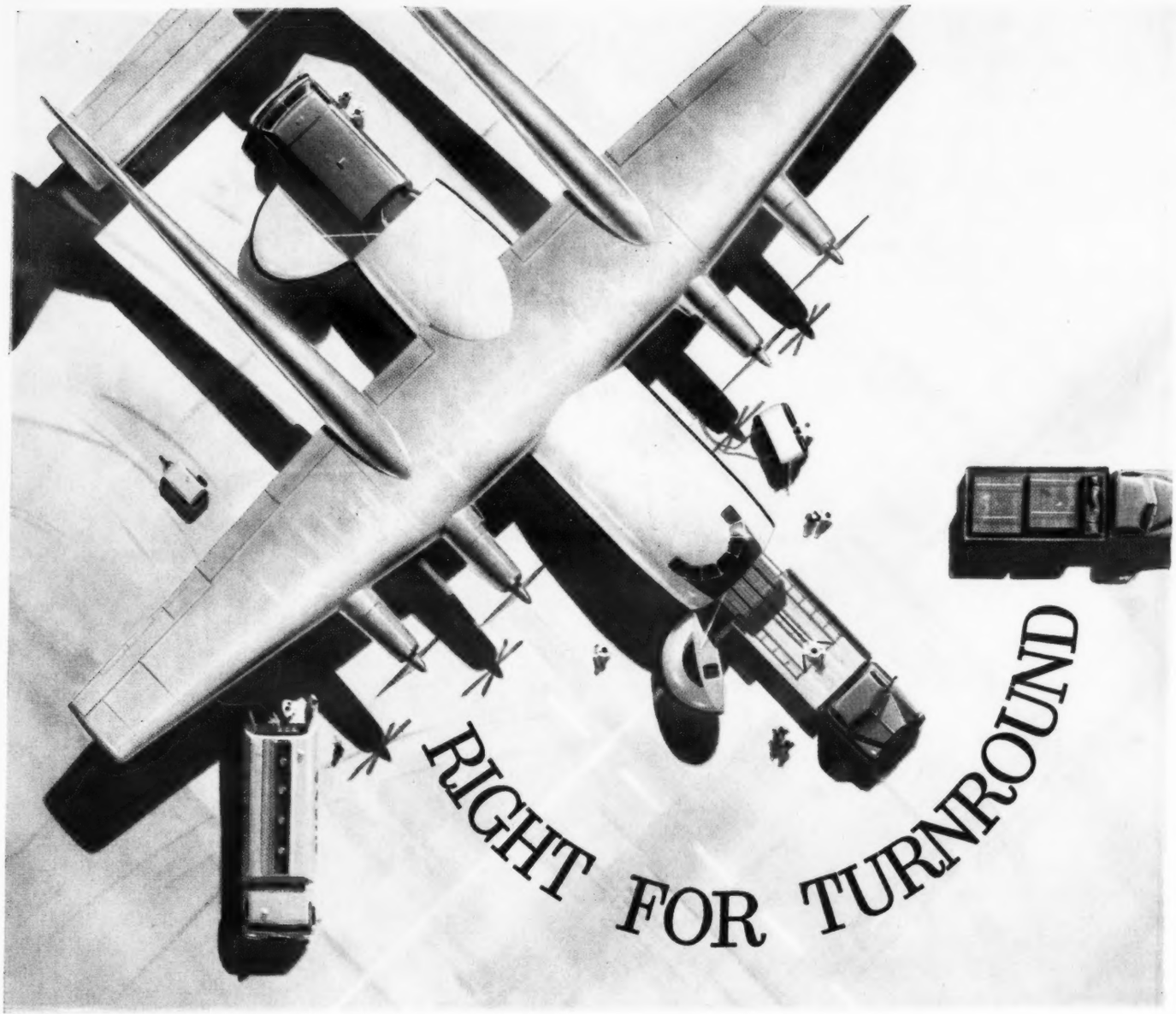
. AIR FRANCE



Intrepid



BIG FORE-AND-AFT DOORS AT PERFECT LOADING HEIGHT ENABLE THE ARGOSY TO LOAD AND UNLOAD WHOLE CARGOES IN UNDER 20 MINUTES

The less you handle cargo the cheaper the transport operation. This is true particularly of air freight where quick turnround is essential if costs are to be kept to a minimum. With the Argosy (AW650) a loading system is being developed that will enable the huge freight hold to be cleared and filled again in a few minutes. With full-width doors at either end of the fuselage, the load can be discharged at one end while new cargo is being loaded at the other.

High pressure refuelling ensures that a turnround can be completed in under 20 minutes. If the Argosy is used for mixed traffic—a role for which it is particularly suited—passenger and freight loading take place simultaneously.

The use of well proven components, particularly the Rolls-Royce Dart prop-jets, promise exceptional utilisation for round-the-clock operations.

PERFORMANCE

POWERED BY 4 ROLLS-ROYCE DART PROP-JETS

AIRCRAFT CRUISING SPEED: (14,000 r.p.m.) 296 m.p.h.
MAXIMUM PAYLOAD: 27,000 lb.
RANGE WITH FULL FUEL RESERVES AND 20,000 lb. PAYLOAD: 1,000 st.m.
SIZE OF HOLD: 46 ft. 8 in. (14.23 m.) x 10 ft. (3.05 m.)
FLOOR AREA: 426 sq. ft. (39.6 sq. m.)

THE ***Argosy*** BRINGS THE COST OF AIR FREIGHT DOWN TO EARTH

DESIGNED AND BUILT FOR THE HAWKER SIDDELEY AVIATION DIVISION BY SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD.

Sud Aviation SE.3200 heavy helicopter, with three 800 h.p. *Turmo IIIB* gas turbines. Diameter of main rotor approx. 49.2 ft.; overall length 47.6 ft.; gross weight 15,650 lb. for civil use, or 16,530 lb. for military operations; max. permissible gross weight 17,640 lb.

Hispano Suiza has, finally, gone into the manufacture of ejection seats through its participation in Société d'Exploitation des Matériels Martin Baker (SEMMB), which has recently been founded in conjunction with Martin-Baker for the licence production of the latter company's ejection seats in France.

Missiles and rocket motors

At the newly-completed plant at Salbris, *Société Générale de Mécanique — Aviation — Traction* (MATRA) showed me its latest products in the guided missile, rocket launcher, etc. field. This company's production programme includes above all the *R.511 air-to-air weapon* with two-stage solid-propellant unit (used, for example, in the *Vautour* and projected for the *Mirage III*) and the *R.442 surface-to-air missile* with two-stage SEPR solid-propellant rocket motor.

This leads us to *Société d'Etude de la Propulsion par Réaction* (SEPR), France's major company engaged in the development of liquid-propellant rocket engines for aircraft and missiles. SEPR concerns itself mainly with prototypes and pre-production engines, while actual production is passed out to various subcontractors. For example, Hispano Suiza will manufacture the production model 841 engines for the *Mirage III*.

SEPR has also recently greatly expanded its solid-propellant section, apparently with a view to developing motors for guided missiles.

Chief exports are anti-tank missiles

In recent years *Nord-Aviation* has become best known in the European market for its *Noratlas* civil and military transport. This "maid of all work" was built in large numbers for the French Air Force and is today being produced under licence in West Germany. In addition Nord-Aviation has received production contracts for the *Nord 3202* two-seat trainer and the *Nord 3400* lightweight observation aircraft.

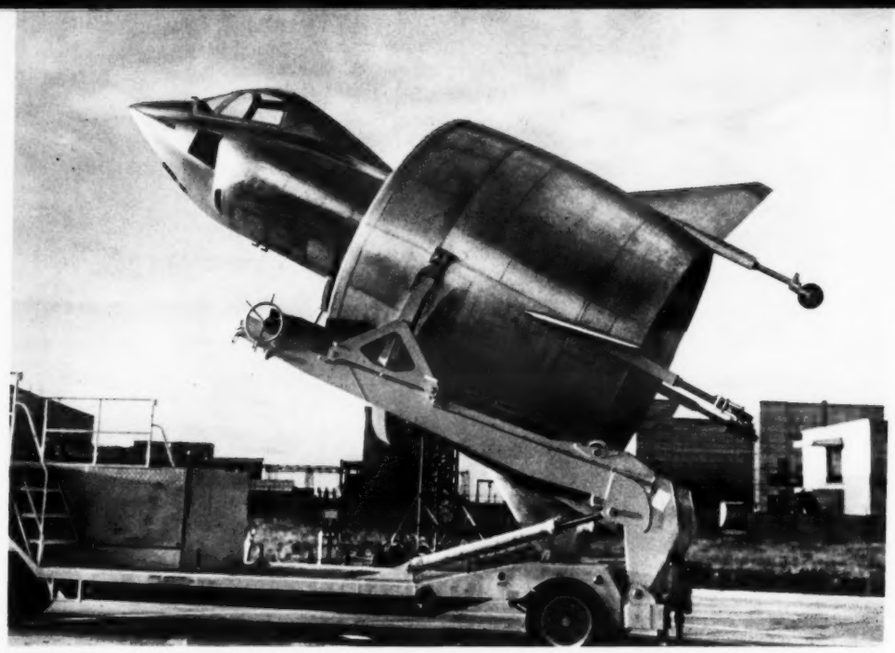
Of particular interest is the tremendous expansion which the company's missile division has experienced these past few years. In its export figures for 1958, *SS.10 and SS.11 anti-tank missiles* accounted for roughly 50 percent of the total value. Nord-Aviation has so far delivered more than 23,000 SS.10/SS.11s, and several tens of thousands more are still on order.

In the *target drone* field, mention should be made of the newly-developed *CT.41* model which is designed for relatively high supersonic speeds, is fired by means of two powder rockets and has two ramjet engines for sustained propulsion.

The *Gerfaut* and *Griffon* experimental aircraft are still being used for a variety of test purposes. Nord-Aviation is at present employing the *Gerfaut* to test the Dassault *Super Aida* fire control system, while the *Griffon* is carrying out advanced testing of its combined turbojet/ramjet powerplant.

Sud Aviation *Alouette III* with 700 h.p. *Artouste IIIB* gas turbine. In the civil role this helicopter can carry six passengers, plus the pilot.

To date Nord-Aviation has delivered more than 23,000 SS.10 and SS.11 anti-tank missiles, and several tens of thousands more are on order. Picture shows an *Alouette II* with four SS.11s.



The demonstration of the SNECMA/Nord Coleopter C-450 is expected to be one of the main attractions of this year's Paris Show.

A glance at the immediate future: Nord-Aviation has joined with the West German firms of Weser Flugzeugbau, Hamburger Flugzeugbau and Ingenieurbüro Blume to form a Franco-German development team. Main task is to design a medium turbine-powered transport for a payload of roughly 18,500 lb.

SNECMA — Coleopter and Super Atar

By the time the Paris Show opens the Coleopter, which has been built jointly by SNECMA (engine and controls) and Nord-Aviation (airframe), will probably have made its first free flight tests. At the time of my visit to Melun-Villaroche, first tests under the rig had largely confirmed the design values, so that there remained no major obstacles to beginning free flights. The demonstration of the Coleopter will doubtless be one of the main attractions of the Show this year, particularly if the whole transition cycle—vertical take-off, transition to level flight and vertical landing—can be demonstrated.

Meanwhile SNECMA is continuing production and development of the *Atar* jet engine. The newest version is the Super Atar (cf. *Interavia* No. 12, 1958) which is to power aircraft for speeds of Mach 2 to 3. Basically, the structure of the Super Atar resembles that of the *Atar 9*. Most important design features are: small number of compressor stages, high power-to-weight ratio and extensive use of standardized components. Thrust class is given as 22,000 lb. It is not impossible to forecast whether the present negotiations with a large American engine manufacturer, not hitherto publicized, will have been concluded by the opening of the Paris Show.

A glance at Orly before departure

My "Tour de France Aéronautique" was over. My plan was to spend my few remaining minutes with friends, but as luck would have it I ran into Monsieur Guillemin, of the Paris Airport Authority, with whom I then spent a very interesting quarter of an hour.

The passenger who must put up with the very crowded conditions in the provisional terminal buildings at Orly certainly does not realize what is being prepared for his benefit in the immediate neighbourhood. He will probably see the gigantic framework going up, but the casual spectator can have no conception of the "Orly of tomorrow." The fact that the total sum of roughly 15,000 million French francs (even in devalued francs equivalent to around $35 million) has been appropriated for the Paris Airport Authority—chiefly for Orly and Le Bourget—during the current fiscal year alone reveals clearly enough that the French Government is fully aware of its responsibilities in this direction. The area of Orly Airport, at present 1,900 acres, is to be increased to 4,500 acres by 1961, and the expansion programme includes two east-west runways, each 11,000 ft. long, one for take-offs and the other for landings. When everything is completed in 1960, Orly will be able to handle up to 60 aircraft per hour.

*

My assignment as technical reporter was to outline the present status of the French aircraft industry, with due reference to the production activities of the various companies and their responsible engineers. I was given a very friendly reception wherever I went and, as I am certainly not a "machine," I could not help reflecting a little on the changes that are now taking place and on the future prospects of the industry.

The industry has a hard year behind it. The de Gaulle Government, and in particular its extremely careful Finance Minister Pinay, have not been throwing millions around; funds have been tightened up, production contracts cut back, and many a project unhesitatingly abandoned. Nevertheless, the atmosphere has if anything been improved by these measures, and the industry is on the way to better health. Not only the French Head of State, but also the industrialists are quite sincere in their efforts towards a greater degree of European cooperation. Though at present they frequently have to content themselves with taking out foreign licence rights, their ambition is still to equal in their own field the West's two major aircraft industries, those of the United States and of Britain.

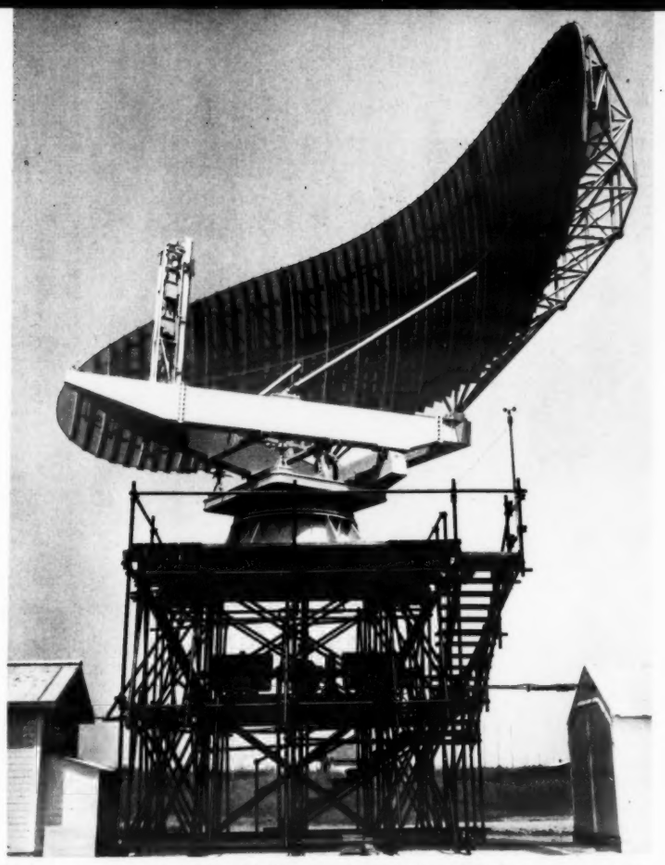
A total of 150 Nord 3400 artillery observation aircraft (260-h.p. Potez 4D34 engine) is under construction.

General drawing of the new terminal building being erected at Orly Airport, Paris. National Road No. 7 passes underneath the building and the apron. During 1959 alone, roughly 15,000 million French francs are being spent by the Paris Airport Authority (mainly on Orly and Le Bourget).

Nord 3202 two-seat trainer with 240-h.p. Potez 4D32 engine. Nord-Aviation is manufacturing 100 of these aircraft.

The French Electronics Industry

By General L. M. Chassin, Paris



Radar antenna constructed by CSF (Compagnie Générale de TSF) for long range radar.

Part I: Introduction

Although unknown a few years ago, the word "electronics" has now been promoted to the position of "keyword" of today's civilization, while the specialists have been unable to give a satisfactory definition of it. For certain of them, electronics is "the science of weak currents", for others "the science of infinitely brief time periods". For the plain man in the street, electronics is concerned with everything connected with the electron. For the International Electrotechnical Commission, electronics is defined as "that branch of science which studies the phenomena of conduction in a vacuum, in a gas and in semi-conductors, and with the utilization of devices based on these phenomena". In fact electronics does not seem to be restricted to this field despite its vast range. Every day new discoveries increase its scope. It is at the same time an applied science and an industry. A giant which does not cease growing, it touches upon those fields which until yesterday appeared to be remote from it, the human sciences and physiology included. It extends our senses of sight, of hearing and of touch, even the scope of the human brain. From the electron microscope, the electronic telescope, radar, television, to the infrared telescope and the computing machines and robot controls of tomorrow, it has been called "the new nervous system of humanity to which the atom will supply the power".

The development and growth of the French industry

The electronics industry has not remained long in its primary application, which was that of radio communications. In the words of the French High Commissioner for Atomic Energy M. Perrin, "One speaks of the atomic age, it is more the electronics age one should say, for electronic techniques affect the detection of metallic ores, the protection of personnel, the control of reactors, the safety in operation and the possibility of remote control. Medicine, biology and agricultural research are affected, as are metallurgy and the heat treatment processes of metal. The principles of automation must be entirely revised as a result of the progress introduced by electronics. The telephone, the automatic control of trains, are in course of modernization thanks to its applications."

The electronics industry is therefore a vital industry for a country. Its growth has been extremely rapid everywhere. In France it has quadrupled its turnover in ten years, rising from $101,420,000 to $417,850,400 and doubling its personnel from 30,000 to 60,000. Agreed these figures are still very modest in relation to those of the United States ($8,105,600,000 and a million employees) and of Great Britain ($1,217,040,000 and 190,000 employees). But here and now one can say that in the field of research and in the quality of production the numerous French achievements are in the international class. Exports for 1958 exceeded $42,596,400 (as against barely $21,284,000 for imports) and the trend is continuous expansion.

General characteristics of the electronics industry

The general characteristics of the electronics industry are particular to itself. In the first place, pure research is of primary importance. It is an industry of "brain power". In no other field is the number of research workers and laboratories so high, and the cost and investment required so great. An electronic project can cost many million dollars before the problem has been resolved in a manner which permits industrial production. Consequently only the very large companies can undertake certain projects, and this affects the future of the industry. Certainly there is still a great deal of room for the small specialist enterprises, holders of patents and special processes. However it is incontrovertible that a process of concentration is taking place in France. There are no more than three manufacturers of radio tubes and only two manufacturers of television tubes. Despite this concentration, which is often beneficial, the electronics industry cannot develop without considerable support from the State. In the United States half the expenditure under the heading of research and development has been financed by the Government in the following proportions: 61 percent for electronics/electricity, 43 percent for telecommunications, 87 percent for aviation. For the greater part of its output moreover, the electronics industry has the defence authority as its chief customer, in which conditions of profit, although important, remain secondary. It has been proved in the course of the century that defence requirements are often the basis of scientific progress which is to the benefit of all.

In the second place, electronics research requires as close an international cooperation as is possible. Without contacts between the experts of many different countries—for the best brains are not always found in the most populous countries—the major successes would not have been achieved. Apart from citing the Manhattan project—the result of cooperation between the Dane Bohr, the German Einstein, the Italian Fermi, the American Oppenheimer, and the English and the French—it is certain that the present research on controlled fusion has made giant strides after the Geneva discussions. International conferences, congresses, discussions and similar "symposia" should therefore be encouraged, as this is the essential for continued electronics progress.

The third characteristic is that electronics is an expensive industry, not only due to research, but also due to the material techniques it produces; and because these techniques develop very rapidly, its equipment becomes rapidly obsolescent and must often be disposed of and written off at a loss.

Finally the last important characteristic is in relation to personnel. In 1958 in the French electronics industry the proportions were as follows: for government equipment and national defence, engineers 10 percent, technicians 27.5 percent, administrative 13.5 percent,

Surveillance radar antenna constructed by SNE (Société Nouvelle d'Electronique).

skilled craftsmen 33 percent, and unskilled workers 16 percent, making 51 percent "technicians" and 49 percent "workers". Such a proportion poses, in France at least, great problems of training which necessitate a drastic reform of our secondary, university and technical education.

Structure of the industry

The electronics industry can be divided into four branches:

industrial equipment;

electronic tubes and semi-conductors;

domestic equipment (radio and television receivers and electro acoustic equipment);

spare parts.

In 1957 the turnover for these four sub-divisions was $164,158,000, $79,107,600, $50,710,000 and $133,874,400 respectively. In respect of exports and imports only the section "tubes" is in deficit, the largest credit section being that of "receivers".

It is the section described as industrial equipment with which we are concerned at present. It is this section which produces the equipment for use in the air and on the ground for aviation.

Part II: The electronics industry and aviation

Aviation has rapidly become a customer of electronics. Compared with 1918 when on a Breguet 14 there was not a single piece of electrical apparatus, now the aeroplane may be described as "flying electronics". With the increase in speed, electronics have been introduced everywhere, at first in telecommunications, and then into the bombing, gunnery and navigation equipment, and finally into pilotage. Today on certain modern foreign aircraft 60 percent of the price is related to electronics, a percentage which attains sometimes up to 40 percent in France. On missiles the share of the new industry is even greater and reaches 60 percent.

The characteristics of the electronics industry are strongly marked in the aviation field. Of the 22,000 employed in this field 70 percent are technicians. Of the total turnover, which exceeds $133,874,400, 85 percent is taken by the "large" companies*, which number 13 out of the total 60. This clearly demonstrates the tendency towards concentration. Aviation electronics invests 7 to 8 percent of its total turnover each year in the construction of laboratories and modern factories. Certain research centres, particularly well equipped, house more than 1,000 engineers and technicians, whose varied activities range from research on ion propulsion to mass spectrographs for the isolation of isotopes.

* Companies employing more than 300 men.

The fields of aviation electronics

The main activities of the electronics industry as applied to aviation are the following:

ground based radio guidance equipment, comprising the whole range of airfield radar;

aircraft equipment. Pilotage, navigation, bombing, air gunnery, telecommunications and airborne radar;

electronic computers used for the research, testing and employment of aircraft and A.A. weapons;

equipment designed for guided missiles (on the ground or on the missile);

equipment for jamming and counter-measures.

Radar

In the radar field, the French electronics industry is well in the forefront. It constructs the whole range of equipment used both on the ground and in the aircraft.

For aerial defence

long-range surveillance radar;
detection and interception radar;
fire control radar;
aircraft radar for all-weather fighters and missile guidance.

For civil and military air traffic

surveillance radar (distant or local);
precision approach radar.

In each of these fields considerable progress has been achieved in France.

Progress

The multiple stage beam radar has been developed by several companies. With four beams this ensures a coverage up to 300 n.m. in range, and up to 96,000 ft. in altitude with an accuracy of 0.5° in bearing and 800 yards in range. These radars employ two antennas back to back, each with two wave guides. This produces four lobes ranged vertically with considerable overlap. The system offers numerous advantages:

the best utilization of energy and possible reduction in size of antennas;

coverage giving range and altitude at the same time;

simple suppression of permanent echos and rain clutter;

low vulnerability to jamming (use of several receivers);

great flexibility of employment (either early warning or fighter control).

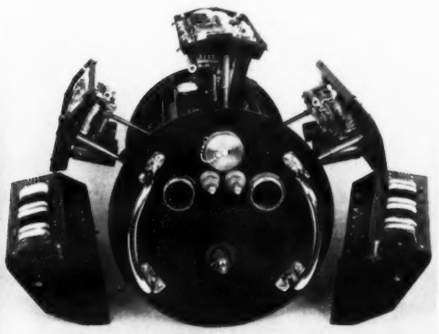
The test laboratory at the Thomson-Houston establishment (CFTH), Bagneux.

Knowledge of the altitude of the enemy remains one of the difficulties of detection; this the multi-beam radar gives approximately but with insufficient accuracy, and necessitates special height finding aerials. French electronics engineers have worked for a long time to overcome this problem by producing a volumetric radar, or 3-dimensional radar. The principle of this is to sweep the air space in height with a very fine electromagnetic beam at the same time as the antenna sweeps in azimuth. The volumetric radar has the advantage of giving the altitude with accuracy at long ranges and of eliminating permanent echos and rain clutter. At the moment it has the disadvantage of not being able to cover a sector of more than 15° in elevation. The SNE (Société nouvelle d'Electronique) radar gives a range of 200 n.m. with an accuracy of 1° in bearing and an accuracy of 660 ft. in altitude at 100 n.m.

In the field of utilization of the received signals, the chief improvements concern the use of multi-frequencies, improvements in the radar image and the elimination of parasite echos.

The multi frequency system introduced to radar techniques by the CSF (Compagnie Générale de Télégraphie sans fil) consists of employing, instead of a single transmitter/receiver, two or three units operating on slightly different frequencies and striking the antenna at some microseconds interval. The three signals A, B and C are received and combined by carrying out one of the following combinations: A + B + C, AB + BC + CA (A + B) (B + C) (C + A) or A × B × C, the third combination being theoretically the best. This method, improved by the use of a "memory tube" which functions as a "coincidence selector", increases the probability of detection, prevents jamming and also reduces the weight and size of the equipment. In practice three transmitters of power P operating in multi-frequencies are equivalent to a single transmitter of power 3P but are actually superior in terms of increased reception and operational performance.

The improvement of the radar image, which for a long time has compelled operators to work in semi-darkness, and its replacement by an image visible to the naked eye in a normally lighted room, has been achieved by CSF, who by means of a "memory tube" has transformed the radar image into a television image.



An airborne radar manufactured by CSF for military applications. The container is sealed and pressurized and the chassis sectioned for accessibility.

In consequence instead of seeing the image decay almost immediately, and relying only on the trace to give an idea of the track of the detected target, the use of a "memory tube" enables the trace of the target to be retained for as many minutes as desired, and to erase it as soon as there is danger of confusion. Thus the image transformer improves the radar technique. The suppression of fixed echos which often render the centre of the radar screen useless is achieved by employment of the Doppler effect, which enables a distinction to be made between a fixed and a moving target. By the comparison on a memory system of two successive sweeps it is possible to remove the fixed echo, whose amplitude is always the same, while the moving echo possesses a certain variation.

The memory can be produced either by a delay line or by a memory tube (CSF), the latter being the most convenient as the delay line system, whether it be liquid (mercury) or solid (quartz), necessitates installation in thermostatic surroundings.

A 1 kW TACAN beacon manufactured by LMT (Le Matériel Téléphonique) undergoing field trials.

As for cloud echos, which depend on the radar wavelength and are particularly inconvenient below 10 cm, these can now be eliminated by using a circular polarization of the wave transmitted by the radar.

Increasing range

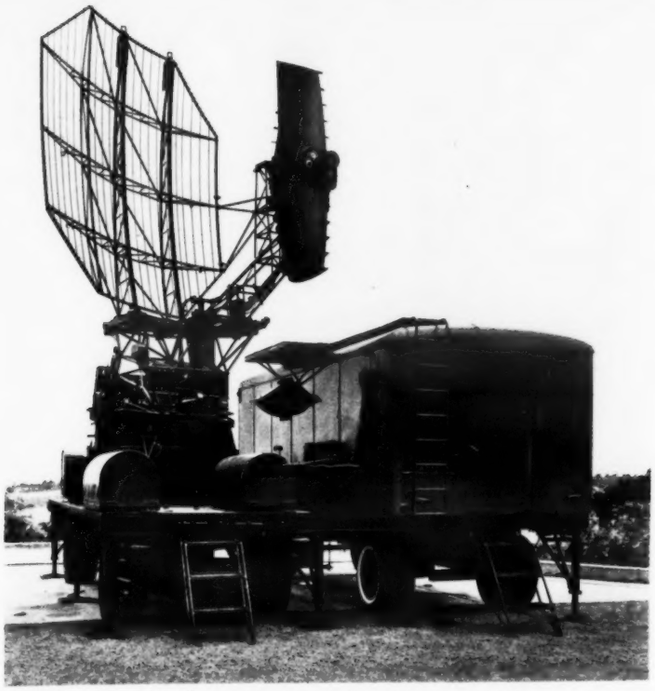
Apart from this progress, efforts are being made to increase the range of radar by increasing the emitted power and the sensitivity of detection.

The increase in power extends from the use of the multiple cavity magnetron to the Klystron or the travelling wave tube. The magnetron does not appear to be able to exceed a power of 5 megawatts and furthermore lacks stability. The Klystron, based on the modulation of the speed of an electron beam emitted by a cathode and passing several resonant cavities, gives greatly increased power (up to 50 MW) but, owing to intense X-ray emission, must be lead shielded for personnel protection.

The travelling wave tube employs the exchange of energy between a wave travelling at low speed and an electronic beam. This apparatus does not require resonant cavities and can operate without special adjustment over a large range of frequencies. Several travelling wave tubes arranged in series will provide an amplification system. It appears that in future radar will employ a similar technique. These tubes are also used in radar receivers to replace crystal detectors, which are extremely fragile. They also offer the same degree of sensitivity as a crystal system. In the field of antennas the reflectors described as "double curvature" should be noted. These provide a powerful radiation at high angles of sight.

Together with minimum signals and the employment of long duration pulse technique, new devices are being developed in France such as the MASER (Microwave Amplification by Stimulated Emission of Radiations) which is based on variations in the levels of energy within molecules. The present trend is towards development of frequency modulated continuous wave systems employing Doppler effect for the detection of targets, rather than pulse techniques. Such systems enable the band width to be reduced, and it will be possible, in conjunction with a suitable receiver, to achieve ranges of several thousand nautical miles, such as are required for the detection of ICBMs, with present transmitter powers.

The problem of guidance of space missiles has also been studied and would appear to be overcome simply enough by fitting on board the missiles a responder operated by radar pulse. For a weight of about 40 lb. it is possible to build a pulse transmitter of 10 kW peak, with a range exceeding 270,000 n.m. from a low gain aerial.

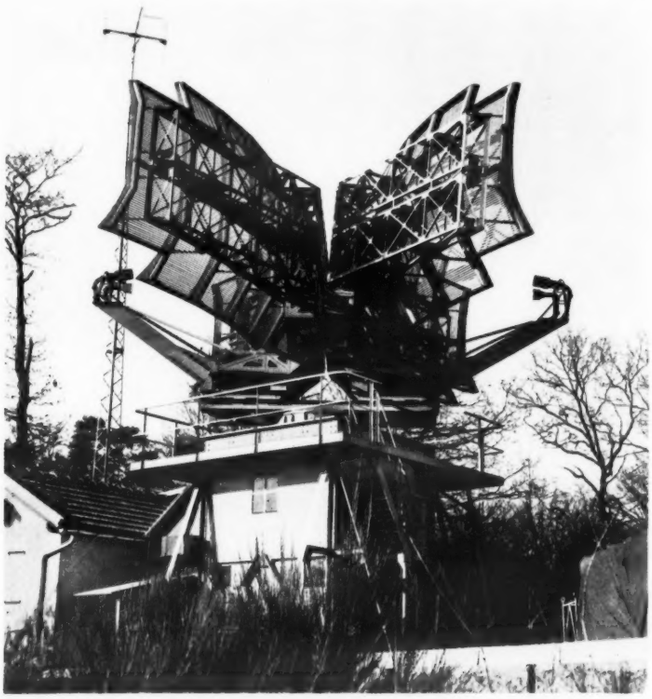


A mobile volumetric radar antenna (Crusoe I) constructed by SNE.

Airborne radar

In the field of airborne radar, notable progress has also been achieved. These radars, which are in the region of 400 lb. in weight and 4.2 cu.ft. in dimension, carry out the search and tracking of the target, the telemetry and calculations indicating if it is possible to fire and the optimum firing point, and finally the guidance of the missile released by the aircraft. This radar (CSF CYRANO) employs a monopulse technique with four waveguides, and the range exceeds 16 n.m.; the 60° cone of search enables the fighter to employ the most violent manoeuvres. The flush mounted aerial system allows the installation of a considerable amount of equipment without affecting the aerodynamics of the aircraft. For speeds up to that of sound the radomes are made of polyesters; silicon resins are used up to Mach 2 but above Mach 3 ceramics are required. Also the antennas will be efficiently combined with the flight refuelling probes.

A back-to-back multiple beam antenna for long-range surveillance radar built by SNE.



Before leaving radar, mention should be made of the systems for automatic transmission of aerial defence information (STRIDA), and radar simulators for the training of personnel in conditions as close as possible to reality.

The semi-conductors

It is impossible to review the whole field of electronic equipment used in aviation. It is necessary, however, to say a word on the technique of semi-conductors, which has completely transformed electronic apparatus.

The study of semi-conductors is based on the behaviour of electrons in crystals and dates from the old "crystal set" whose working was not clearly understood. As a result of numerous laboratory experiments, it was discovered that the introduction of certain impurities such as arsenic, antimony, gallium and indium gave some conductors (germanium, silicon) properties which would be profitable to exploit. Thus was born the junction transitor, which has revolutionized radio-electricity. In spite of difficulties which appeared to be unsurmountable ten years ago, it is now possible to manufacture semi-conductors on a commercial scale which are capable of replacing vacuum tubes in nearly all applications.

Transistor technique is extremely delicate, and only the large firms can handle the problem, in particular CSF and Thomson-Houston.

Today they produce apparatus combining improved performance, great strength, long life, low current consumption and in particular small dimensions which enables considerable miniaturization to be effected. More and more the barriers of frequency and power are being overcome. In the laboratory, frequencies of 10,000 megacycles have been achieved. In the field of power, some germanium power transistors deliver 3 kW to the collector. Combining both power and high frequency, certain new transistors already give high wattage at high frequency. As to rectifiers, they supply from 500 up to nearly 1,000 amperes per unit. In spite of certain difficulties (reaction to heat in particular) the transistor will replace vacuum tubes everywhere and its future in aviation and missiles appears unlimited.

Ferro-electric materials

Essential element in the memory of computers, the ferro-electric or ceramic capacitor is composed of a magnetic oxide or mineral salt whose properties have rapidly made it one of the key electronic materials. UHF ferro-electrics are used in radar waveguides. They enable both the Faraday and resonance absorption effect to be employed.

Ferro-electrics for computing machines are special components which have the property of presenting two stable states corresponding to the figures 0 and 1 in a binary code. These memory devices weigh about 5 milligrammes. They are exceedingly difficult to manufacture (requiring extremely close control over atmosphere and temperature during treatment). The mounting of the matrices requires exceptionally delicate manipulation (a matrix carries 4,000 units in each of which four wires pass). Combining the metallurgy of powders and the physics of ceramics, ferro-electrics require for their manufacture as high a degree of automation as is possible, together with large output and industrial resources.

Electronic measuring equipment

The cathode ray oscilloscope is an almost universal instrument, with almost no inertia, which gives by means of a luminous trace on a screen all the functions indicating the variation of a phenomena in relation to time. It is therefore an important electronic measuring device, particularly for the measurement of forces, accelerations and speeds, etc. Apart from this remarkable instrument, electronics offers an extremely wide range of apparatus. Amplifiers, amplification recorders, electronic gauges, automatic potentiometers, accelerometers, level indicators, microcomparators, and measuring equipment for vibrations, pressures, thicknesses and audiometers.

More and more the measurement of phenomena becomes electronic.

Other articles by the same author on the major members of the French electronics industry and on present development trends will be published in these pages beginning with the August 1959 issue.
Editors

Italy's Production Effort

Four Italian Air Force Fiat G.91s on an operational training flight.

By Dr. Giorgio Lourier, Interavia Rome

Italie

For the flying display in Paris the Italian aircraft manufacturers grouped under the Associazione Industrie Aeronautiche will provide a number of new designs which were available only in model form two years ago: the Agusta Z.8-L airliner, Fiat G.91 light strike fighter, Macchi MB. 326 jet trainer, Piaggio P. 166 executive aircraft and the Agusta 102 helicopter. In addition a number of old acquaintances, such as the Piaggio P. 149 touring aircraft, the L1 and L2 sister versions of the Piaggio P. 136, and the Agusta-Bell 47 J helicopter, will also be seen in the skies above Le Bourget. With the exception of the Agusta 102 and Z.8-L prototypes, all the aircraft types shown are in production and in service in some numbers both in Italy and abroad.

The stands inside the exhibition building will show products of the following companies: Aeronautica Macchi, Costruzioni Aeronautiche Giovanni Agusta, Fiat, Industrie Meccaniche Meridionali Aerfer, Piaggio, Aerea, Bombrini Parodi-Delfino and Microtecnica. Other probable exhibitors are Aer-Lualdi and SIAI-Marchetti.

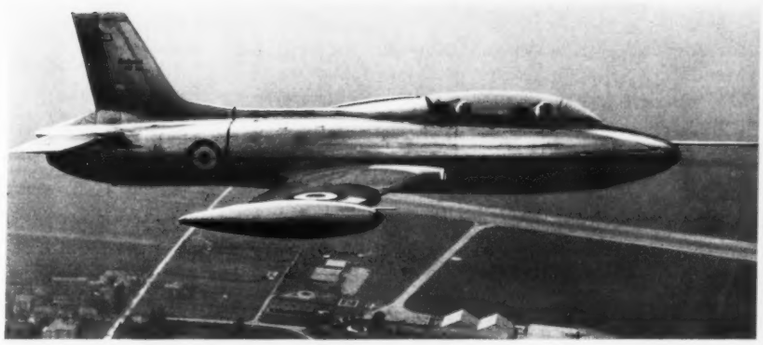
*

The most striking Italian exhibit at this year's Paris Show will certainly be the *Fiat G.91* lightweight ground support aircraft designed for the NATO air forces (with Bristol *Orpheus* engine), which is due for delivery to several different countries in three versions—a combat aircraft, an armed reconnaissance model and a trainer. An international G.91 squadron has been formed within NATO for tactical cooperation exercises with the land forces. The high degree of manoeuvrability of this aircraft, its ability to operate in varied roles, interchangeable weapon combinations, reasonable initial cost and operating expenses and good flying and take-off qualities (operation from semi-prepared airfields) are all features which will recommend it to military planning staffs.

The *Macchi MB.326* two-seat trainer is now powered by an Armstrong Siddeley *Viper 11* jet, instead of the *Viper 8* as originally intended. The aircraft's performance has thus been improved, without prejudice to its qualities as a military trainer. It is also to be equipped with training armament (two machine guns and a camera gun).

The *Agusta Z.8-L* (four Alvis *Leonides 502/5* engines), a medium-range commercial transport for 22 to 26 passengers, is now undergoing flight development. It is designed primarily for economical operation of local services.

For the businessman and his team *Piaggio* offers the *P.166* executive aircraft (two Lycoming GSO-480-B1C6 engines) for six to eight persons and a range of up to 1,000 nautical miles. Designed for all-weather operation, it is equipped with full blind flying instrumentation, radio navigation equipment, autopilot, radar and de-icing.



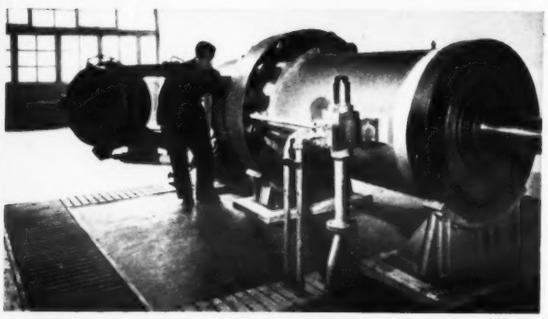
Macchi MB.326 two-seat jet trainer.

The Piaggio P.166 six-to-eight-seat executive aircraft . . . was derived from the well-known P.136 amphibian (below).

Prototype of the Agusta Z.8-L four-engine short-range transport for 22 to 26 passengers.

Model of the Fiat 7002 helicopter.

Plastic external container (for 500 lb.) by Aerea.



Orth press for rocket propellant charges (Bombrini Parodi-Delfino).

Another twin-engine design is the *Piaggio P.136-L1* (and *L2*) amphibian (Lycoming GO-480s or GSO-480s), for air taxi, sea rescue and coast-guard roles.

Of the two Agusta helicopters at the Show, the four-seat *Agusta-Bell 47 J* (260 h.p. Lycoming VO-435) is a licence version of the well-known American type, while the ten-seat *Agusta 102* (600 h.p. Pratt & Whitney R-1340) is an original design by the Cascina Costa, Gallarate, company. Destined for medium-range feeder services, the Agusta 102 has a service ceiling of 14,000 ft.

Fiat, too, is exhibiting a helicopter, though only in model form. This is the *Fiat 7002,* whose power is supplied by a Fiat 4700 gas turbine compressor (roughly 500 e.h.p.) feeding compressed air to blade-tip nozzles: weight equipped approx. 1,320 lb., useful load roughly 1,760 lb.

*

Three small engines of 42 h.p. and 82/83 h.p. will be on the Meccanica Verghera stand (an associate of Agusta), namely the GA-40 (for fixed-wing aircraft) and the two versions of the GA-70 (for helicopters and fixed-wing aircraft).

The work carried out by *Aerfer, Macchi* and *Fiat* for the NATO air forces (production of spares, overhaul and maintenance of aircraft) will be illustrated by pictorial displays; *Bombrini Parodi-Delfino* is expected to bring to Paris a selection of ammunition, rockets and examples of solid propellants; *Aerea* will show plastic tanks for fuels and napalm, as well as VHF radio equipment and special practice bombs; and finally *Microtecnica* will offer synchronous motors (50 and 400 cycles), gyroscopic horizons and a range of cabin accessories under Bendix and AiResearch licence.

*

Italy's exhibits are thus designed to give an insight into the country's industrial accomplishments of the past two years. Although the Italian Air Force receives most of its equipment under Allied military aid programmes and although Government credits to the national industry are still very restricted, Italy's manufacturers have maintained production at an excellent level, as is tellingly revealed by their export records.

Agusta 102 ten-seat helicopter.

Piaggio P.149D four-to-five-seat touring aircraft.

Agusta-Bell 47-G 2

BEA 47 J helicopter

COSTRUZIONI AERONAUTICHE

GIOVANNI AGUSTA

CASCINA COSTA GALLARATE
ITALY

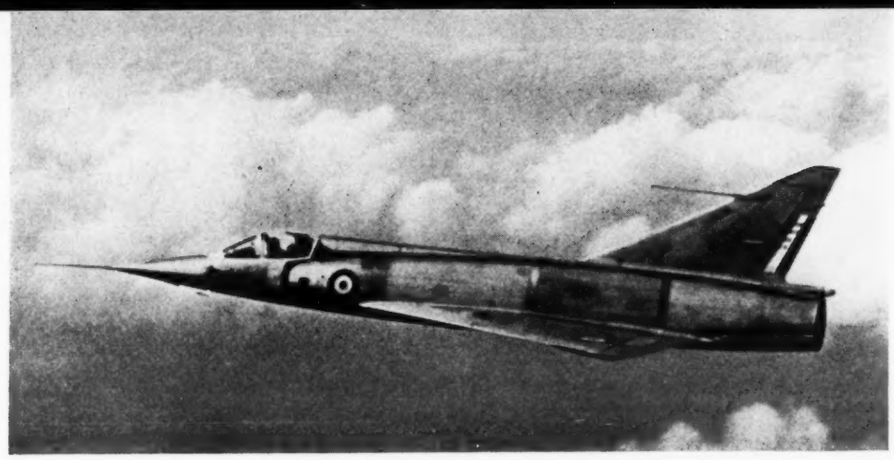
Agusta-Bell 102

mb.326

Jet training aircraft
in quantity production
for the
Italian Air Force

AERONAUTICA MACCHI - VARESE

Founded in 1912



The first few years of the 1959 long-term programme will see the quantity production of aircraft of the Daussault *Mirage III* family.

Long-Term Programmes for the French Industry: 1950 and 1959

by P. M. Gallois, Paris

This year, the French aviation world will have the double privilege of holding an international Air Show of exceptional quality and of acquiring an Aircraft Production Bill.

The responsible authorities and the industry have been waiting for this bill for more than a year. Early in 1958 the Ministry of National Defence had undertaken to announce its content before the middle of the year. But political events postponed this plan, modifying the targets which had been accepted under the Fourth Republic and changing the national background against which the programme of aeronautical development and production had to be set.

*

The last plan had been elaborated and adopted in 1950. Its object had been to organize and finance five years of aircraft development and production, working along two basic principles:

- To restrict the proliferation of aircraft types which had been characteristic of the immediate post-war period, by concentrating technical and financial resources on the production of the smallest possible number of different aircraft types.
- To free the aircraft industry from dependence on the annual budget votes and above all from the debates on the Finance Bill which had meant that manufacturers could never be sure from one year to another whether a given development or production project would be continued. The idea had not been to escape from Parliamentary jurisdiction, but to ensure that a number of " obligational authorities " should be voted at once, and annual payments agreed to finance these programmes.

The first of these principles was met in full, but the second ran up against certain difficulties, since Parliament insisted on a regular detailed study of the budget and on exercising its own rigid control.

Nevertheless, the plan was adhered to on the whole. It met the country's essential needs and corresponded roughly to the resources which France was willing to devote to her aviation. These funds admittedly were meagre. At the time, the spokesman for the Senate's National Defence Committee described the situation as follows: " *For years past each American citizen has been devoting from 25,000 to 30,000 francs annually to aviation, while the British have been spending 10,000 francs each per annum on the development of the air force. By contrast, the forty million Frenchmen grant only 1,200 francs per head to air affairs.*"

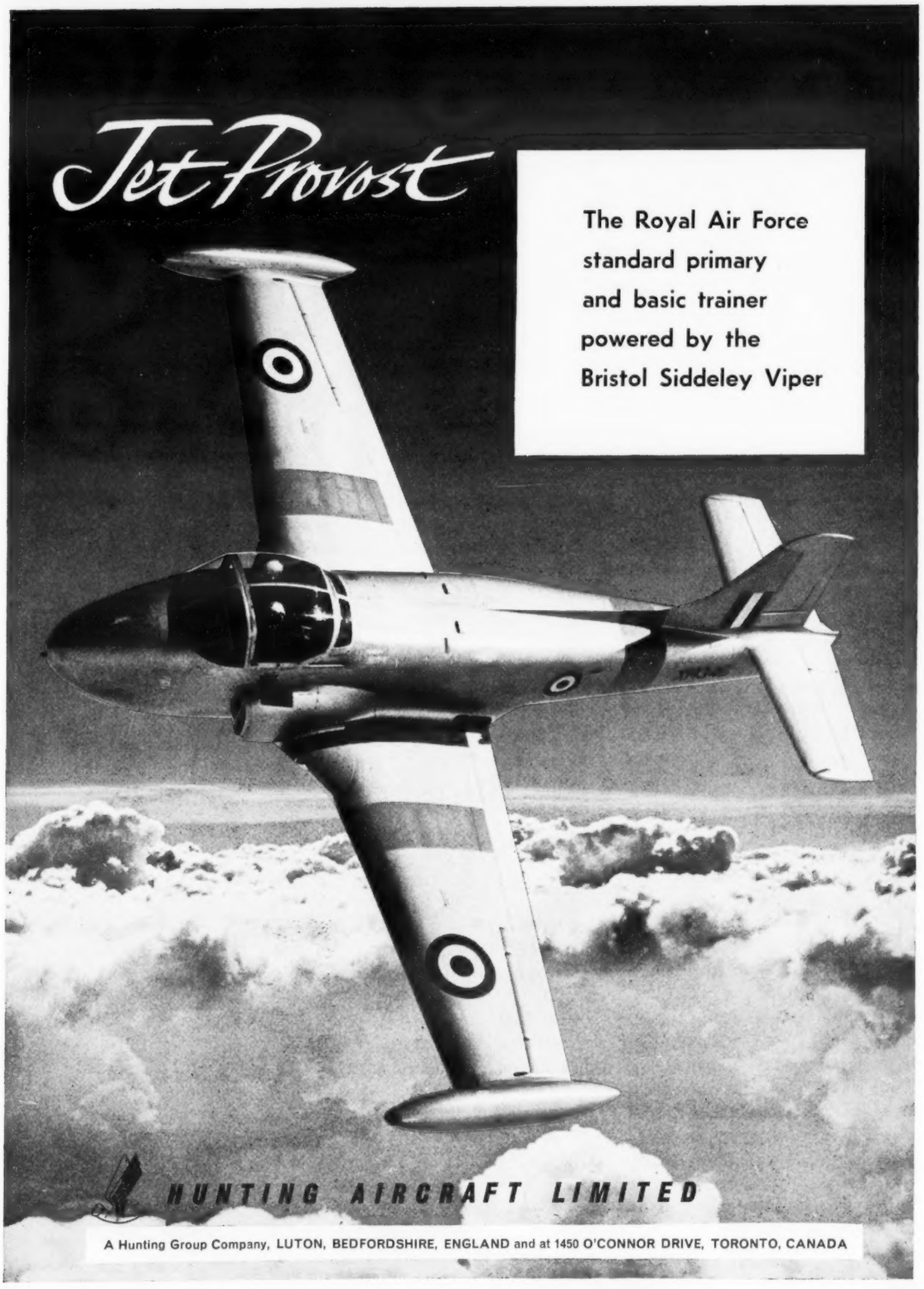
Originally, the plan was in two sections, one falling within the limits of the funds normally allocated to aviation, and the other based on the assumption that Parliament would appropriate the necessary supplementary credits. The first section was passed without difficulty, but the second struck the legislators as too costly. Nevertheless the aircraft it covered were all authorized at a later date and all were ultimately manufactured. The plan led, directly or indirectly, to the production in quantity of the equipment which is in service today with the French Air Force or a number of foreign air forces. Aircraft produced under these arrangements include the *Ouragan* and *Mystère*, the Nord 2501 " medium " cargo aircraft, the Morane 732 and Fouga *Magister* trainers, and the aircraft for the Naval Air Arm [1]. Finally, under the " development " heading, the Ministry of Transport also had its word to say. Originally it was planned to develop a 20-to-30 ton four-turboprop transport and a 45-to-50 ton four-jet transport. Later the funds earmarked for these aircraft were allotted for work on a medium-stage airliner, which has now emerged as the *Caravelle*.

*

At his press conference following the demonstration of the Dassault *Mirage IV* twin-engine bomber, Technical and Industrial Director *Louis Bonte* gave the main outline of a new aircraft industry bill which his Directorate has prepared. The differences between planning in 1950 and a similar study made nearly ten years later are obviously great.

[1] The first phase of the plan called for the production of 1,047 fighters, 200 " medium " cargo aircraft, 295 light twin-engine models, 265 trainers, 112 artillery observation aircraft, 150 carrier-based fighters, 25 heavy amphibians, 15 heavy anti-submarine aircraft, 20 light twin-engine aircraft for the Navy. A second phase covered 240 fighter-bombers and 170 trainers, 20 amphibians, 17 anti-submarine aircraft and 20 additional light twin-engine aircraft.

For the Naval Air Arm the new programme is expected to approve the production of the Breguet *Alizé* anti-submarine aircraft.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Ten years ago the experts' task was relatively easy. Aircraft were still flying at high subsonic speeds, and the next stage aimed at was the transonic range. The target everywhere was the " sound barrier ", and it was taken for granted that there would be a levelling off in speed developments at this point. Electronics was beginning to play a leading role both in aircraft and on the ground, but the first lessons of the Korean War had revealed the handicaps of complexity and led to a " rethinking " of combat aircraft aimed at reducing weight and simplifying operational employment. Finally and above all, in France at any rate, there was no question of embarking on the quantity production of missiles, whether of the surface-to-air or the air-to-air category. This field was still covered by the " Research and Development " heading and was not sufficiently advanced for any firm production projects to be made.

Today, it is vastly more difficult to plan aeronautical production even on a medium-term basis—not to mention a long-term programme. The missile has joined the arsenals of the Big Powers in no uncertain manner, and since it has been found possible to miniaturize the nuclear explosive the V 2 and its derivatives have become formidable weapons. In the air defence domain, the combination of a nuclear warhead with a surface-to-air missile compensates to some degree for the slow rate of fire of weapons such as the *Nike Ajax* and restores some of its lost strength to the defence. And a burning question which was not even raised ten years ago is the allocation of responsibilities between the missile and the piloted aircraft.

Again, when it comes to satisfying military needs, the situation has changed not only in the matter of technical advances, but also as regards the origin of the equipment for the squadrons. Around 1950 it had been a generally accepted fact that the United States should supply offensive and reconnaissance aircraft (in actual practice fighter-bombers and their reconnaissance versions) under the Mutual Development Aid Program, while the countries of Western Europe would make every effort to build their own fighters and any other aircraft they needed for defence purposes. These purely European efforts were supported by " off-shore " orders. The situation is vastly different today. Whether in the form of gifts of equipment or of finance for selected development programmes considered to be of value to the Atlantic community, Foreign Aid is no longer as systematic as it was, and the European countries have to cover a greater proportion of their requirements through their own efforts.

After a short breathing space immediately following the Korean War, aircraft have continued to grow in complexity, thus inevitably constantly rising in cost. A B-52 bomber costs some $8,000,000, a F-106 fighter $2,870,000, and Rear Admiral R. E. Dixon, Chief of the Navy Bureau of Aeronautics, recently had to appear before a Congressional subcommittee to explain the cost of the Navy's latest single-jet combat aircraft, which run to $9,900,000 each (including spares). What is more, it is becoming increasingly difficult to forecast costs, as is revealed by the report which Sir Edmund Compton, Britain's Comptroller and Auditor-General, read to Parliament early in March. One of the cases cited by Sir Edmund was that of the *Orion* turboprop, the development cost of which was originally estimated at £6,500,000, but which had since risen to nearly £13,000,000. And nobody has forgotten the passage in President Eisenhower's State of the Union Message, in which he stated that the total cost of introducing the *Atlas* would amount to an average $35,000,000 per missile in firing position.

What renders French planning even more difficult is the fact that there is little resemblance between development and production conditions across the Atlantic and in Europe. It seems likely that an aircraft equivalent to the F-102, even with generous electronic equipment, could be built on this side of the Atlantic for less than the sum estimated in Washington (roughly $1,285,000). Moreover, there is

The 1959 plan also is believed to cover production of the Dassault *Etendard IV M* low level strike aircraft.

yet another difference compared with 1950; the French aircraft industry has now become an exporter. Both quality and price must now be competitive, and full allowance must be made for the industry's new markets.

Unlike the United States and, to a certain extent, Britain, who have extensive " feeder " industries and can thus work on their own resources, France has to import a substantial amount of equipment, whether it be engines, electronic equipment or the high precision " mechanics " needed for the guidance of missiles.

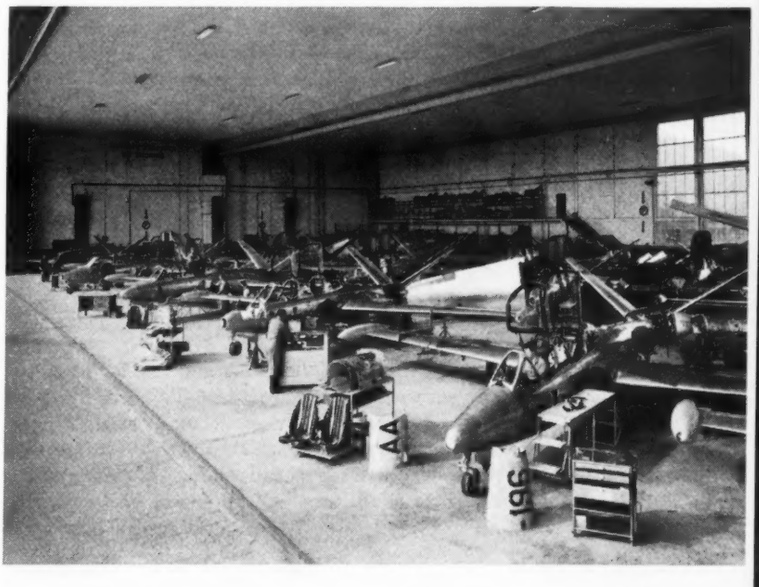
These were some of the obstacles which had to be overcome and some of the facts which had to be taken into consideration in drawing up a plan to ensure that France's design offices and production shops are given as constant a work load as possible, while remaining within the budgetary limits set by the Government and meeting the needs of the military users.

*

No details of the *1959 plan* are known, but only the broad outline.

Like the 1950 five-year plan, it provides for a direct follow-on for equipment now in production, as well as maintaining in production those aircraft which are of undeniable operational value. For example,

Final assembly of Fouga *Magister* jet trainers at Messerschmitt's Munich-Riem plant.



Loading a Sud Aviation *Alouette* helicopter fuselage aboard the Nord 2501 *Noratlas* transport.

it reportedly still retains the Nord 2501, the Fouga *Magister* and the Dassault *Mirage III*.

The Nord 2501 has more or less become the French *Dakota*. Certain improvements have already been made in the design, and still others may later be added to its proven airframe. The success of the *Magister* twin-*Marboré* jet trainer, which is being exported to a growing list of countries, is well known. Its basic formula will give rise to a whole " family " of aircraft and will long remain valid with little or no change. It is therefore entirely reasonable to keep this aircraft in production and to plan for only gradual modifications.

As for the *Mirage III*, deliveries of the production models will be made during the first few years covered by the new Production Bill. In this model, France has the only Mach 2 aircraft which can operate from runways half the length of those required by yesterday's subsonic aircraft. There has probably been some discussion on the advisability of providing the Mirage III with a Mach 3 successor. The decision may be positive, though in the defensive field, quite apart from the fact that the piloted interceptor will be replaced in part by surface-to-air missiles, it would seem to be preferable to improve the aircraft's means of detection, guidance and fire control rather than the actual airframe. If the " platform " remains unchanged, the engineers will no doubt put all their efforts into equipping it with a detection system of longer range, with air-to-air missiles capable of tighter manœuvres, with greater speeds, more lethal warheads and less susceptible to jamming. In other words, the formula which is believed to be that of the F-108 will not be followed in France. Europe's geographical situation does not require its use, and it would be only sensible to spend the money on more important tasks.

For the Naval Air Arm, the new plan is believed to incorporate the recent authorizations for the quantity production of the Dassault *Etendard IV M* low level strike aircraft and the Breguet *Alizé* anti-submarine aircraft. Including the Sud Aviation *Alouette* helicopter, which has given France a leading position in the world rotorcraft market, this makes at least six existing aircraft types which can be expected to remain in production for some long time to come.

Engineer General Bonte also revealed that, in addition to these aircraft which are already on the production lines, *four new designs* will be developed, and will progressively replace them in the workshops.

● The *Mirage IV A* bomber was the first of the four to be mentioned. The present prototype, fitted with two *Atar 9* jets of 13,200 lb. of thrust with reheat, is merely an experimental machine designed to facilitate and accelerate the development of a *Mirage IV B* of higher gross weight and powered by jets with at least 26,000 to 30,000 lb. of thrust, with afterburner. Like the *Mirage III* and the *Mirage IV A*, this new model will be capable of speeds in excess of Mach 2 in level flight and at altitude. The press has made no secret of the French Government's intention to acquire a striking force whose explosive would be the French nuclear weapon and whose " carrier ", at any rate initially, the *Mirage IV B*. In this way this aircraft would be associated with *France's entry into the group of nuclear nations*. It is easy to see why it figures at the head of the list of new types.

● The second of the four projects mentioned by Engineer General Bonte is the Breguet 1150 naval patrol aircraft, which is destined to succeed the Lockheed *Neptunes* in European waters. The project originated with SHAPE and is based on inter-Allied specifications for a naval patrol aircraft to be capable of keeping a watch on the submarine danger for the next ten years or more. If produced in quantity, this aircraft would engage not only the French aircraft industry but would retain its inter-Allied character in both production and employment.

● The third project is a heavy cargo aircraft capable of carrying a military load of at least eight tons. As is known, the design is the result of collaboration between French and German design offices. The engines, and perhaps the wing unit, would be the same as those in the naval patrol aircraft. Here too the operational life of the planned model may well exceed ten or twelve years. The project is therefore one which will suffer little from the pace of technical advance.

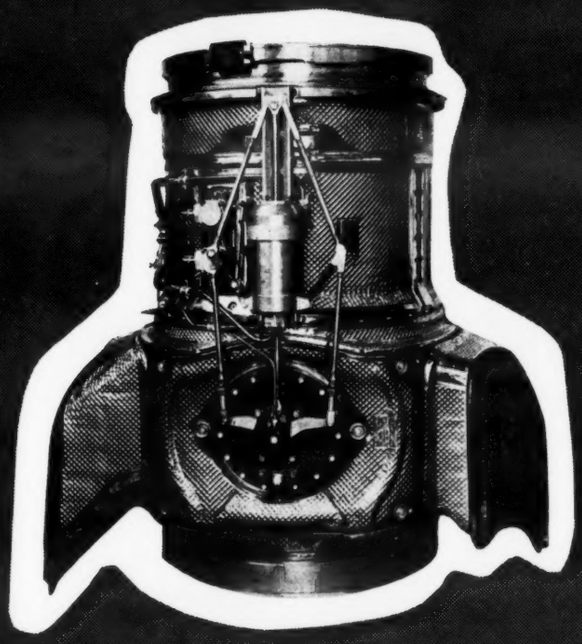
● The light support aircraft is the fourth of the new projects listed under the future programme. So far, neither specifications nor production arrangements have been decided. The need for a heavily armed lightweight ground support aircraft has been felt for a number of years. Hitherto successful use has been made of the piston-engine combat aircraft which the air forces and naval air arms had not scrapped at the end of World War II. But as this source of equipment began to dry up, serious thought had to be given to designing a replacement. Paradoxical as it may sound, the many attempts made all produced disappointing results, which shows that an aircraft of modest performance is not always easy to design. However, Engineer General Bonte stated that there are two rival models in this category, one of them reportedly a new version of Sud Aviation's *Fonceur*, and the other the Dassault *Spirale*. Needless to say, the future of this programme will depend on developments in North Africa. It may even be that the light strike aircraft formula will be replaced by a communications and small transport aircraft also capable of being used for navigation training. The text of the new Bill will probably be sufficiently elastic on this point to permit adaptation to circumstances.

Concluding his survey of the Aircraft Production Bill, Engineer General Bonte also announced that *two ballistic missiles* would be developed, one of them with a range of 2,000 miles, and the other designed for the combat zone, namely for a range of 60 to 120 miles.

*

As regards the existing aircraft, the new programme has the merit of organizing production of types of proven quality with an obvious market. The designs for later production have also been carefully chosen: the naval patrol aircraft and the military (or civil) transport are categories which will have a long operational life and will not suffer to any appreciable extent from the increased use of missiles. There remains the question of competition and the quality of comparable Anglo-Saxon designs. But both these projects have received official inter-Allied approval and will be produced on a European level. This being so, they may well have a chance of coming to something. For its part, the *Mirage IV* bomber, capable of sustaining Mach 2 over long ranges, will not only be a peak achievement for the French industry, but will also be associated with France's " Great Plan ".

From the foregoing enumeration there emerges an outline of the future composition of the French Air Force. The *Mirage IV* will be the instrument of the " deterrent force ", while defence will be provided by the *Mirage III* and by batteries of *Nikes* and *Hawks*, and the overseas units will get light strike or communications aircraft as circumstances demand. The Naval Air Arm will have *Etendard IV M* strike aircraft and *Alizé* anti-submarine aircraft for its aircraft carriers, and later long-range naval patrol aircraft. This is doubtless the composition of a transition force, but in view of the widely varied nature of the threat this force will most probably survive for a long time alongside its possible successor.



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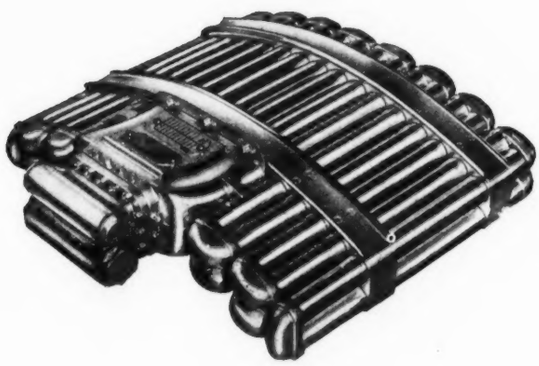

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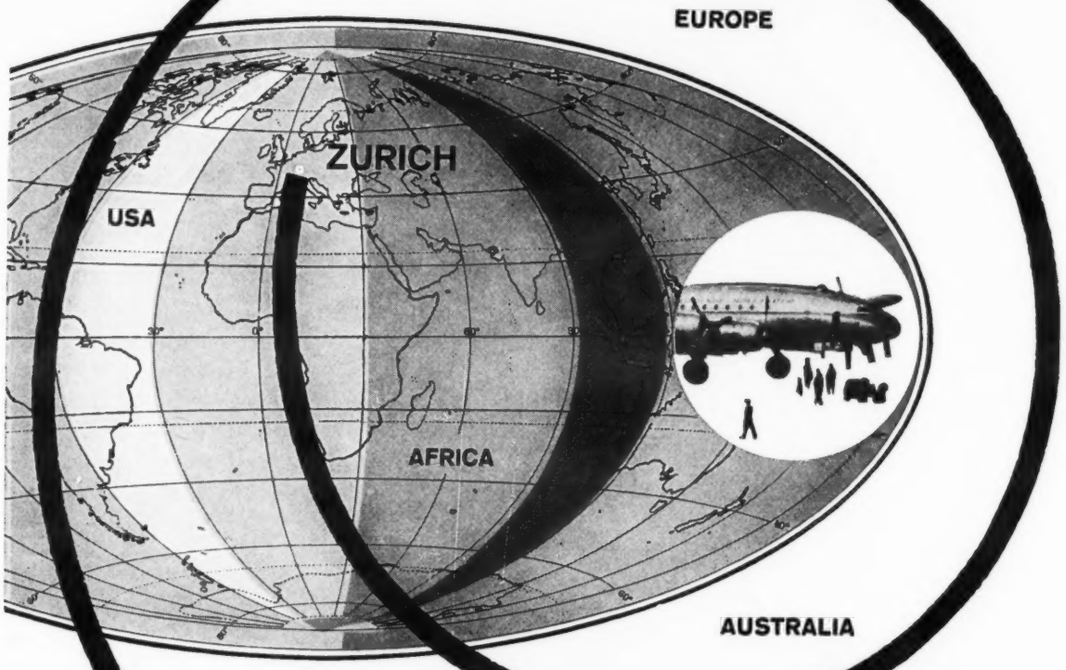

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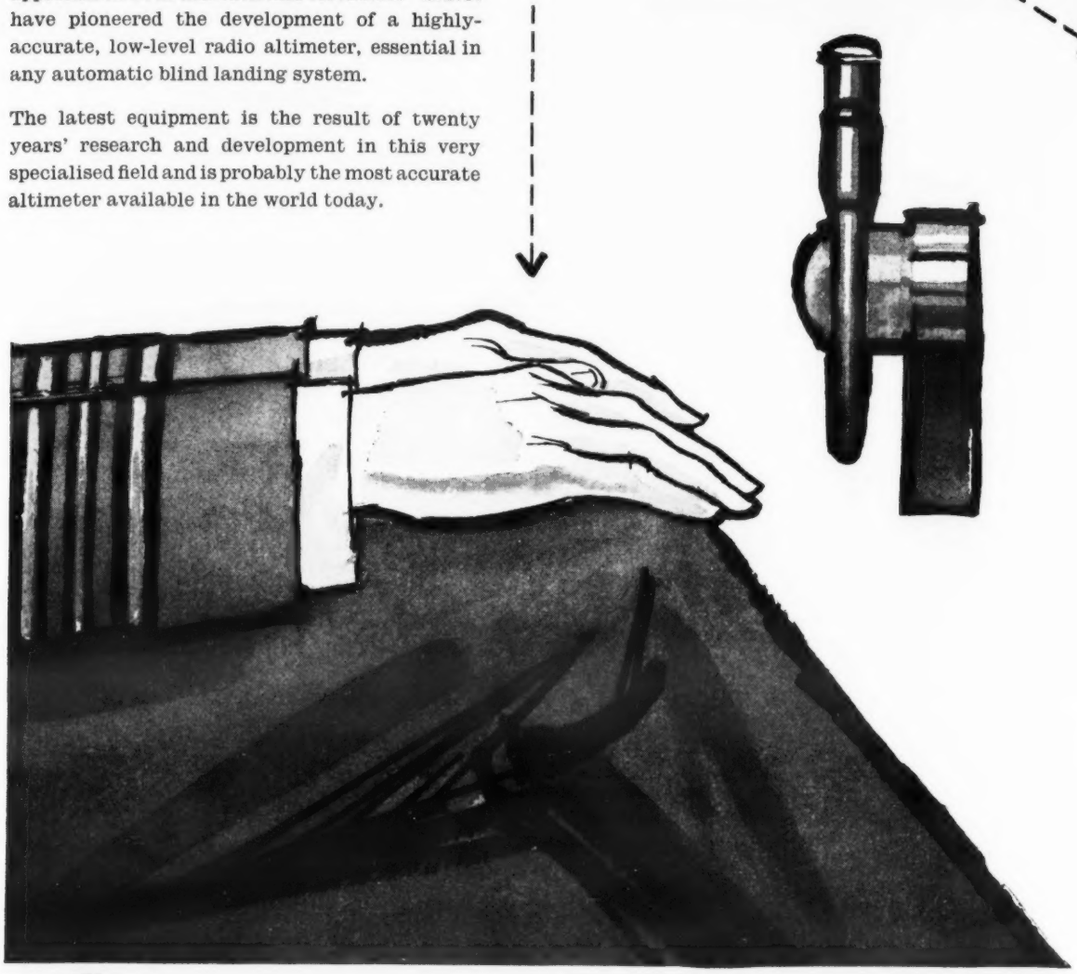

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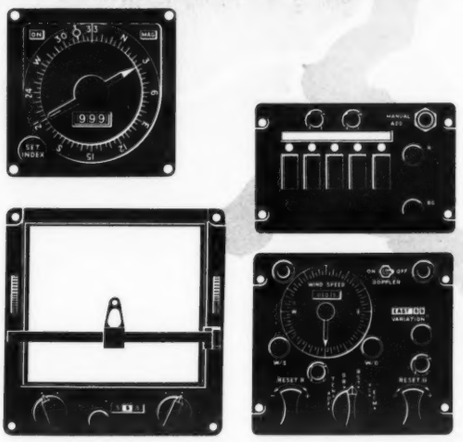

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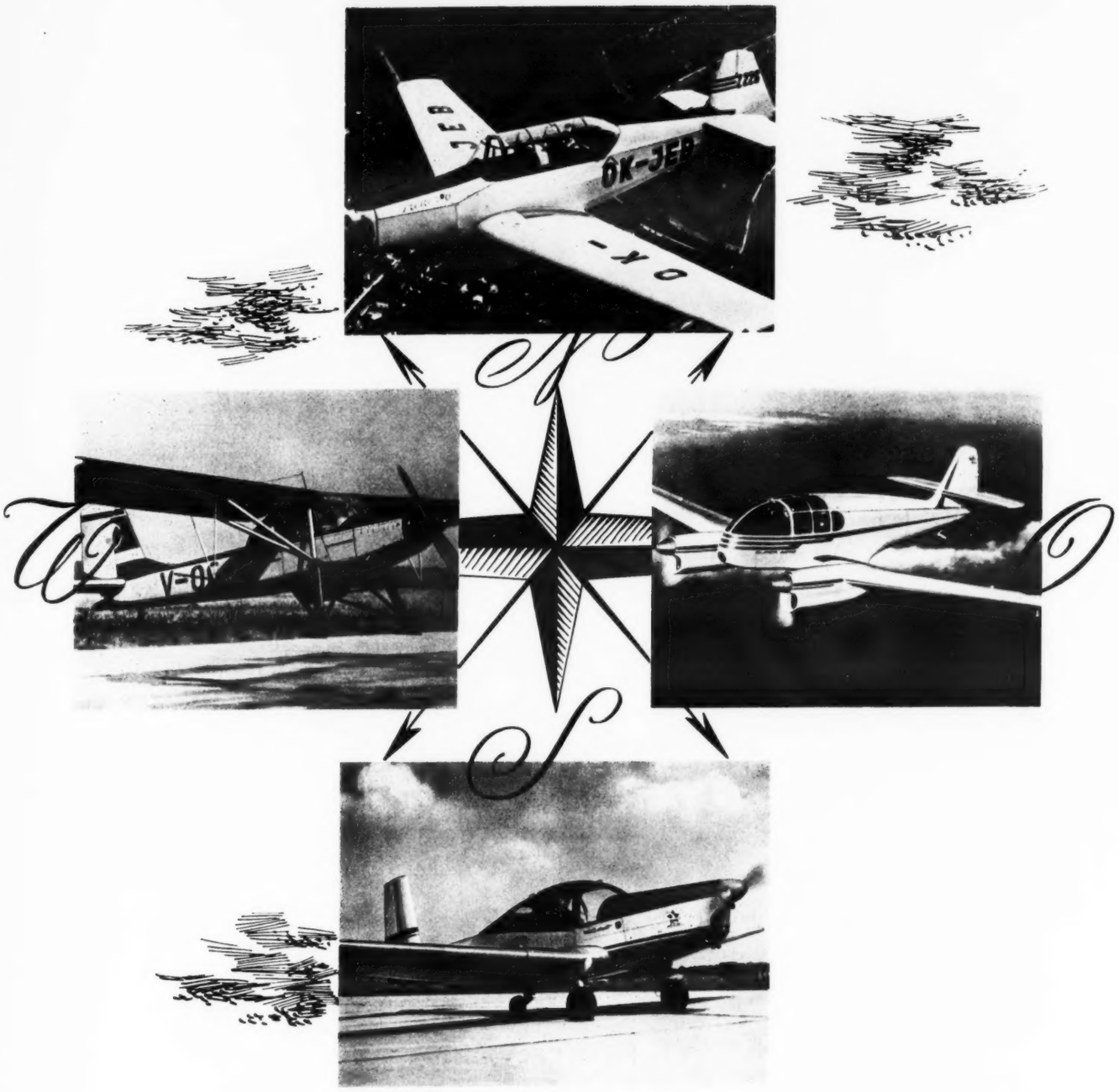

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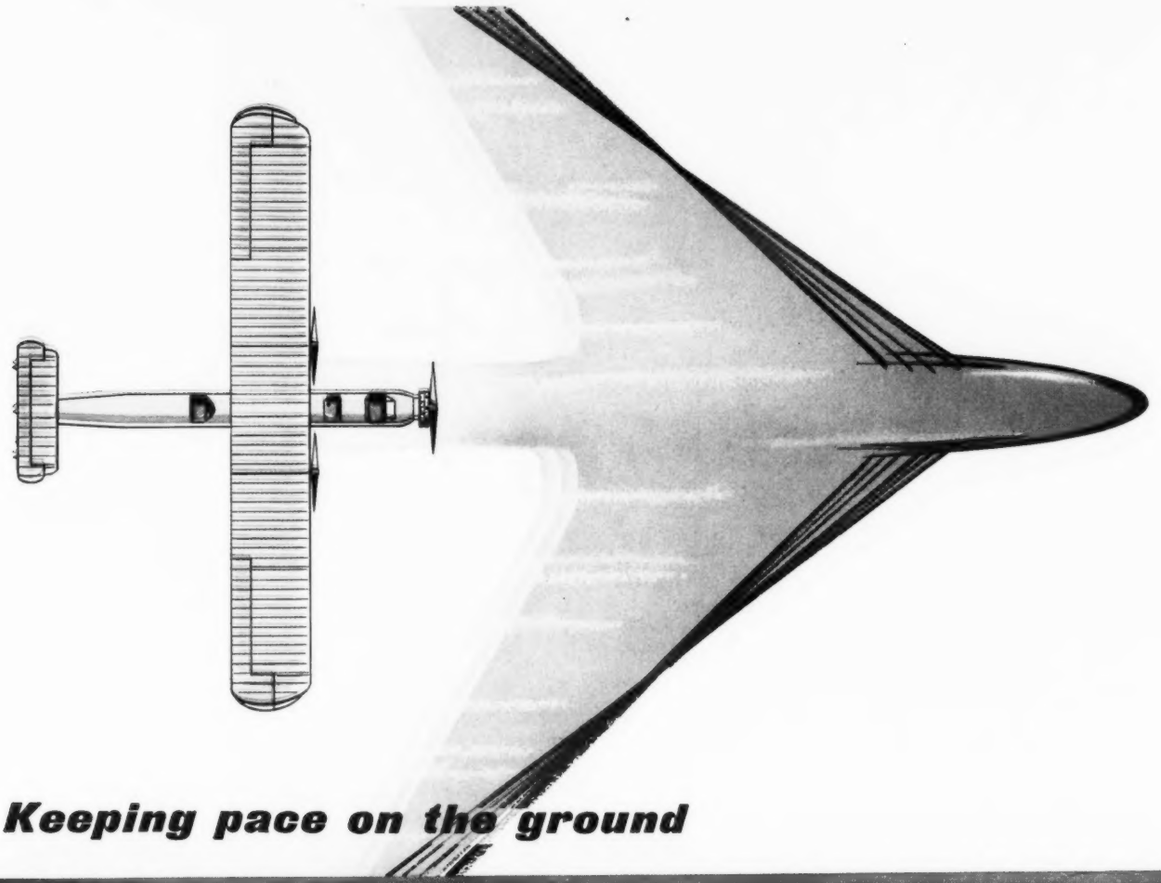
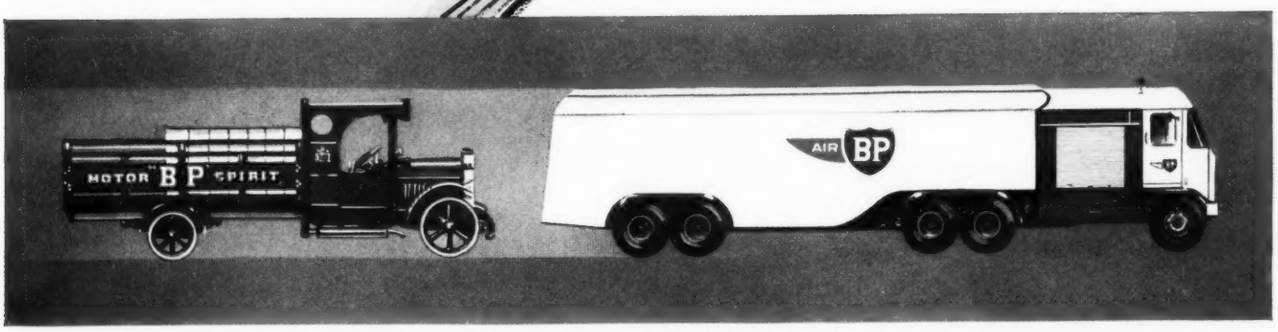


Keeping pace on the ground



with progress in the air . . .

In the air phenomenal advances have been made in a brief span of time. Speeds have increased enormously. Continents are now overflown non-stop. Each year the volume of air traffic grows greater.

Such progress has been made possible only because essential services have kept pace on the ground. In the not-so-distant past when BP began fuelling operations, it sufficed to use 2-gallon cans man-handled from an open lorry. Now the latest airliners require 20,000 gallons a 'hop', to be delivered—because of ever swifter turn-rounds—in less than 20 minutes.

By unceasing research and technical development AIR BP, the pioneer of turbine fuelling, is prepared for this challenge. Its latest 10,000-gallon super-fuellers deliver at 750 gallons a minute; its hydrant systems carry fuel underground right to the aircraft at even higher flow rates. With a new range of lubricants and special products, improved methods of filtration, a complex ground organisation to support aviation, AIR BP is poised today for even greater achievements.

AIR BP

THE AVIATION SERVICE OF BRITISH PETROLEUM

Look up to the DC-8

WORLD'S MOST MODERN JETLINER—BUILT BY DOUGLAS

Turn your eyes to the skies . . . and soon you'll look up to the DC-8 Jetliner.

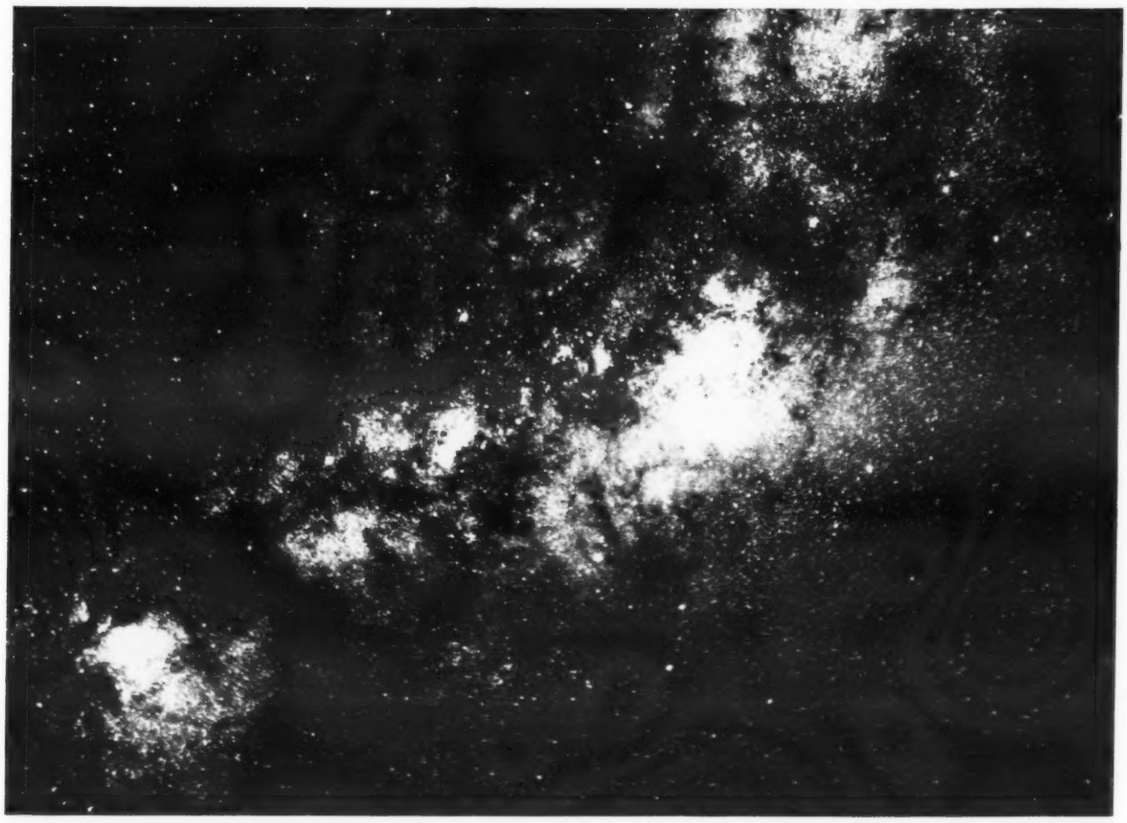
From its gay and glamorous lounge to its special soundproofing to its *Douglas-engineered* seats, the DC-8 is completely designed with *you* in mind!

The new type of *contoured* seat *cradles* you. Press a button and it g-l-i-d-e-s you back to a sleeping position. But don't plan on more than a cat nap. The DC-8 will whisk you to your destination at almost 600 miles an hour!

So look ahead to the most magnificent flying that man has yet devised. Look up to the Douglas DC-8!

These famous airlines already have purchased the DC-8:
ALITALIA-Linee Aeree Italiane • DELTA AIR LINES • EASTERN AIR LINES • JAPAN AIR LINES • KLM ROYAL DUTCH AIR LINES NATIONAL AIRLINES • NORTHWEST ORIENT AIRLINES • OLYMPIC AIRWAYS • PANAGRA • PANAIR DO BRASIL • PAN AMERICAN WORLD AIRWAYS • SAS—SCANDINAVIAN AIRLINES SYSTEM SWISSAIR • TRANS-CANADA AIR LINES • TRANS CARIBBEAN AIRWAYS • TRANSPORTS AERIENS INTERCONTINENTAUX UNION AEROMARITIME DE TRANSPORT • UNITED AIR LINES

Stars seem almost within reach from the upper sky—Kingdom of the DC-8!



The New World's Visiting Card

United States

The term New World, of course, is used primarily to designate the *United States of America,* one of the Big Powers, with a population of 175 millions (6 percent of the world's population) in an area of 3,609,000 square miles (or 8½ percent of the total land area). The annual budget of this super-state in the last two fiscal years was roughly $73,000 million (ten times the figure in 1938), of which roughly $45,000 million was allocated to the defence budget, including more than $10,000 million of this sum for the procurement of military aircraft and guided missiles. According to figures published by the *Aircraft Industries Association of America,* the U.S. aircraft industry's total turnover during the 1958 calendar year amounted to $11,470 million. The latter figure can be broken down as follows:

$5,305 million for approximately 4,000 military aircraft and their spares;

$1,014 million for 6,860 civil aircraft and their spares, plus exports of military equipment;

$1,858 million for piston engines and gas turbines for U.S. military aircraft, and their spares, i.e. for approximately 1,500 piston engines and approximately 7,000 jets and turboprops;

$ 321 million for 10,233 civil engines and their spares;

$ 163 million for propellers;

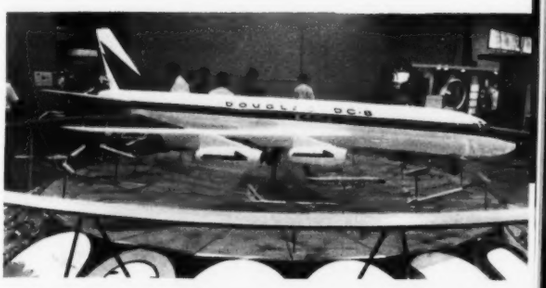
$2,809 million for other products and services, including for example conversions and modifications *as well as missiles* (this figure covers only products supplied by the aircraft industry, not those of other industries).

The American aircraft industry achieved these sales results with an average labour force of 757,500 persons, of whom 479,200 (63 percent) were directly concerned with production: this is equivalent to annual sales of more than $15,000 per head of the work force. Roughly speaking 60 percent of the employees worked in the airframe industry in 1958, 20 percent in engine manufacture and the remaining 20 percent in the equipment industry (including propellers) and parts manufacture.

During recent years this powerful industry has shown a steadily growing interest in the Paris Show: this year at least twelve airframe manufacturers, six engine manufacturers and a good half-dozen equipment companies will be participating in the flying displays or in the exhibition building, in addition to strong direct participation by the *U.S. Air Force.*

1. Airframe manufacturers

● Taking the list in alphabetical order, the first company to be mentioned is **Bell Helicopter Corporation,** of Fort Worth, Texas, who will be demonstrating—for the first time in Europe—the new *Type 204 helicopter,* of which 110 are being manufactured for the U.S. Army under the designation HU-1 *Iroquois*; power is supplied by a Lycoming T53 turbine of 825 shaft horsepower; capacity for six to eight passengers or approximately one ton of military load (troops, weapons, ammunition) or—on short stages—a 2,600-lb. jeep (see picture). Other Bell helicopters will be shown by *Agusta* (Italy), the company's European licence holder, and by various agents.



Exhibits for Paris (Douglas Aircraft)...

...and fully occupied workshops in America: production of the Convair 880 (left) and Lockheed *Electra.*

Vertol 107 turbine-powered helicopter (two Lycoming T53s).

Northrop T-38 *Talon* supersonic trainer.

Mockup parade: top, Sikorsky S-61 (three T58s); bottom, part of the Douglas DC-8 cabin.

● **Boeing Airplane Company,** Seattle, Washington, has had to adapt its exhibits to the available space. As full size exhibits would be somewhat bulky, the company has contented itself with showing a collection of scale models. Considerable interest—not only amongst schoolboys—will doubtless be aroused by the model of a wheel-shaped *Mars vehicle* which would be powered by an ion motor drawing its energy from the sun. A somewhat more "down-to-earth", and hence more immediate, impression, will be made by a 15-ft. cutaway model of the Boeing 707 jet airliner, which will be supported by models of the Boeing 720 medium-stage version, the B-52 bomber and the KC-135 jet tanker. Finally, Boeing will be showing a 4-ft. working model of the IM-99 *Bomarc* pilotless aircraft missile (complete with shelter and erecting equipment) to illustrate air defence methods, and will round off this collection with the only full size exhibit on its stand, the 240 s.h.p. *Boeing 502-10C* lightweight gas turbine engine.

● **Chance Vought Aircraft Inc.,** Dallas, Texas, will most probably be sending one or more F8U *Crusader* supersonic fighters to take part in the flying displays and for exhibition in the static show, though at the time of writing final details are not known. The *Crusader* is now being delivered to the U.S. Navy in the F8U-1P version as an armed photographic reconnaissance aircraft; in August 1956 it set up a national speed record of 1,015 m.p.h.

● The **Convair Division** of **General Dynamics Corporation,** San Diego, California, is in much the same position as Boeing—and as Douglas and Lockheed: full size exhibits would be much too big . . . Here too, the company has had recourse to models, of the CV 880, CV 600 and other types, though a number of genuine USAF service aircraft, primarily the Convair F-102A interceptor and the C-131A ambulance aircraft, are expected to grace the flight demonstrations.

● **Douglas Aircraft Company,** Santa Monica, California, is showing a 15-ft. model of its DC-8 (incidentally, the U.S. manufacturers of commercial transports appear to have reached a gentlemen's agreement on a standard size for their models), as well as a series of panels containing models of such missiles as the *Nike-Hercules, Thor-Able, Genie,* etc. Visitors will also have an opportunity to admire a mockup of one half of the DC-8 first-class cabin showing "double deluxe" type of seating.

● **Hughes Aircraft Company,** Culver City, California, will go to Paris not as an aircraft manufacturer but as a missile producer (and supplier of equipment). Exhibits will include the *Falcon* air-to-air homing missile in the GAR-1D (with radar guidance) and GAR-2A versions (with infrared homing). Models of the Convair F-102A interceptor and its fuselage nose will reveal the installation of six *Falcon* missiles, plus 24 unguided rockets, in three fuselage bays, and the structure of the Hughes MG-10 radar directed fire control system. On a wartime operation the F-102 would carry both types of rocket (three GAR-1Ds and three GAR-2As), as the infrared missiles are fired only in clear air, while the radar-controlled missiles are used primarily in fog, rain, snow or banks of cloud.

● **Lockheed Aircraft Corporation,** Burbank, California, will attract visitors with artistic decorations—a backdrop of sky carrying half reliefs of aircraft and missiles, glass-topped islands showing selected exhibits (e.g. a miniature television transmitter), etc. All three main divisions, California Division (Burbank), Missiles and Space Division (Sunnyvale, California), and Georgia Division (Marietta), will be represented . . . And it may be that a real live USAF Lockheed C-130 *Hercules* or F-104 *Starfighter* will be encountered on the airfield or can be seen flying over Le Bourget.

● Meanwhile it has already been definitely decided that **The Martin Company,** Baltimore, Maryland, will be showing a genuine missile, namely a TM-76A *Mace* borrowed from the USAF in Europe; it will be transported by air, complete with its launcher, from Sembach (Germany), and set up in the USAF's outdoor park. No firing of the *Mace,* which is guided by the ATRAN map-matching system, is planned however . . .

Production Republic F-105 *Thunderchief* supersonic single-seat fighter-bombers.

. . . and Chance Vought F8U *Crusader* supersonic carrier-borne fighters.

Northrop N-156F multi-purpose fighter.

Radioplane RP-77D target drone and launching rig.

● **Northrop Corporation,** Beverly Hills, California, and its three production divisions Norair *(Hawthorne)*, Radioplane *(Van Vuys)* and *Nortronics* (Hawthorne), are represented by an impressive collection of models and a number of full-scale exhibits. Norair is showing a $^1/_6$ scale model of the T-38 *Talon* supersonic trainer, which is to serve as basic trainer for the USAF's Air Training Command, as well as a model (to the same scale) of the N-156F multi-purpose fighter derived from the trainer. Finally there will be a SM-62 *Snark* intercontinental strategic missile, probably in full scale. Radioplane is displaying a series of radio-controlled reconnaissance vehicles and target drones, including in particular the U.S. Army's RP-77D 1,000-lb. aerial target which is powered by a Boeing 502-10F free-turbine turboprop and a 52-inch diameter metal propeller. The Nortronics contribution is discussed later in the article.

● **Republic Aviation Corporation,** Farmingdale, Long Island, N.Y., plans—assuming Pentagon permission—to fly one of its F-105 *Thunderchief* single-seat supersonic fighter-bombers non-stop from New York to Paris, having it refuelled over the Western Atlantic by a KC-135 and over the Eastern Atlantic by other F-105s (on the "buddy" principle). This would in a sense be a repetition of Lindbergh's historic 1927 flight . . .

● **Sikorsky Aircraft,** Stratford, Connecticut, a division of *United Aircraft Corporation,* will demonstrate the amphibian qualities of the S-62 10-seat turbine-powered helicopter (with General Electric T-58) in take-offs and alightings on a pool specially prepared on the airfield, and a full size mockup of the 25-passenger S-61 with three T58s. The heavy S-61 all-weather helicopter is due to make its first flight next spring.

● Finally, **Vertol Aircraft Corporation,** Morton, Pennsylvania, another company with a considerable export market, will demonstrate in Paris its latest helicopter, the *Type 107* (two Lycoming T53s) for up to 25 passengers. A larger version of this helicopter, powered by two General Electric T58 turbines, and designed to carry 40 troops or 3 tons of cargo, will be operated by the U.S. Army under the designation YHC-1B *Chinook*.

2. Engine manufacturers

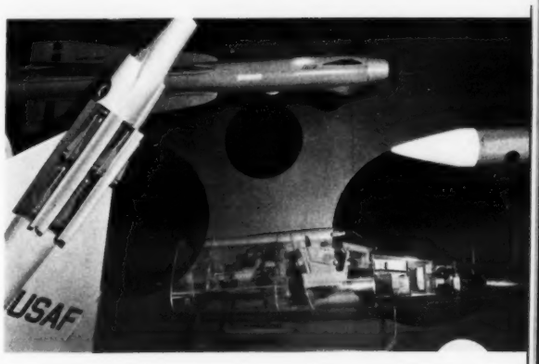
● The **AiResearch Manufacturing Division,** Phoenix, Arizona, of *The Garrett Corporation* (Los Angeles, California), will show one of its new ground support vehicles for jet airliners (gas turbine compressor mounted on a Volkswagen panel truck) . . .

● . . . and **Boeing Airplane Company,** Seattle, Washington, as already mentioned, will display its 502-10C 240-h.p. gas turbine.

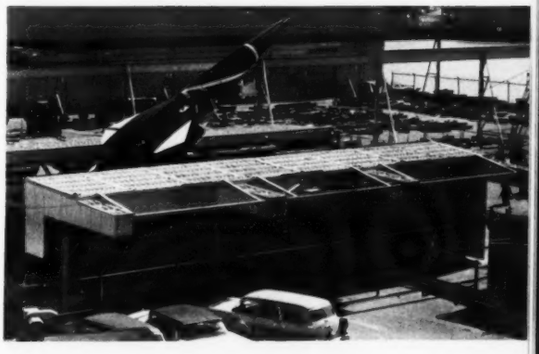
● **Curtiss-Wright Corporation,** Wood Ridge, New Jersey, is expected to appear once again with its standard exhibit, the R-3350 turbo compound engine, and with a number of licence-built jet engines.

● By contrast **General Electric Company,** Lexington, N.Y. and New York City, has a number of new designs to offer: J85-9 lightweight jet (of roughly 2,000 lb. thrust); T64 turboprop/turboshaft engine (of approx. 2,600 s.h.p.); CJ805-23 aft-fan engine (in model form) of approx. 15,000 lb. thrust. The stand will also contain full-size cutaway models of the mighty J79 military turbojet (15,000 lb. thrust class) and of the T58 propeller turbine (1,050 s.h.p.).

● The **Lycoming Division,** Stratford, Connecticut, of *Avco Corporation,* will display—for the first time in Europe—the 860 s.h.p. T53-L-1 gas turbine engine, which is specially designed for helicopter installation,

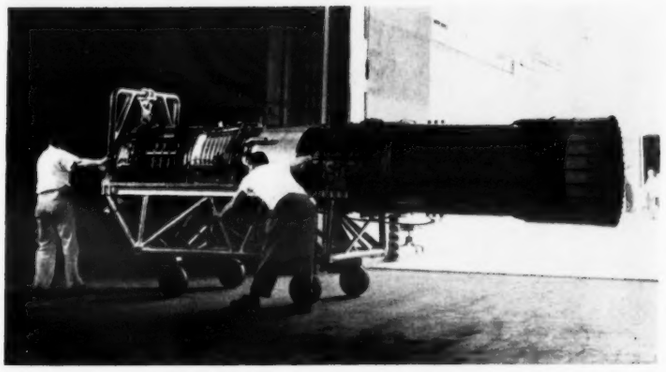


Demonstration material for air defence studies: above, the Hughes GAR-1D and GAR-2A homing air-to-air rockets; below, a Boeing IM-99 *Bomarc* interceptor missile.

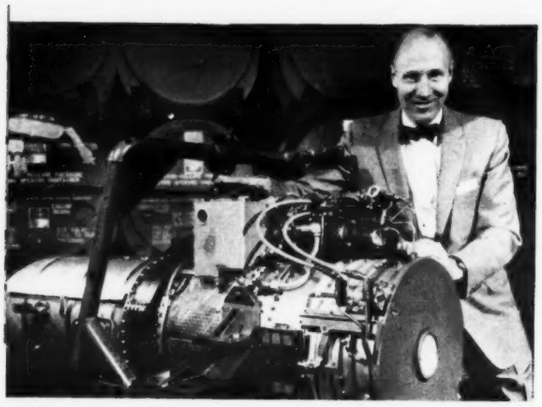


Bell 204 turbine-powered helicopter (one Lycoming T53) with 2,600-lb. Army jeep.

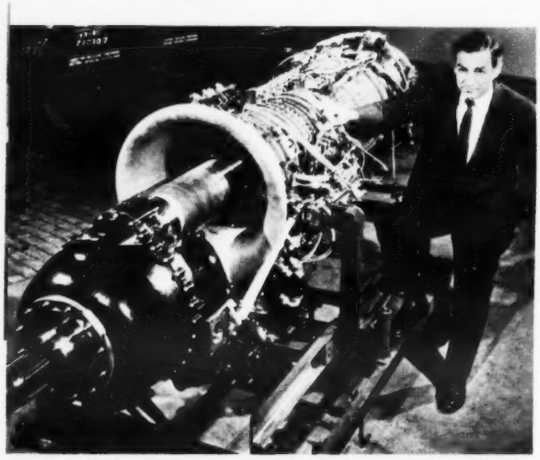
Firing a Martin TM-76A *Mace*.



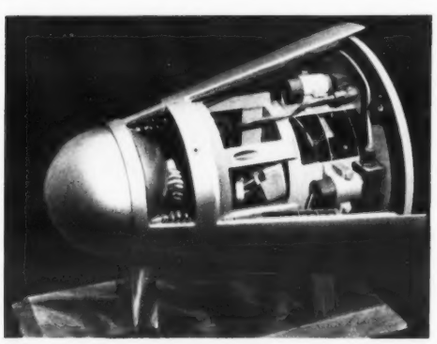
Mighty reheat jets with thrusts of over 22,000 lb.: left, the Pratt & Whitney J75-P-19W; right, the General Electric J79.



J85 lightweight jet engine (top, 2,000 lb. thrust) and T64 propeller turbine (2,600 s.h.p.), both from the General Electric range.



Nortronics "Q" ball sensor, for measurement of angle of attack, yaw and dynamic pressures at extremes of temperature and Mach number.



and its VO-435 (260 h.p.) reciprocating helicopter engine.

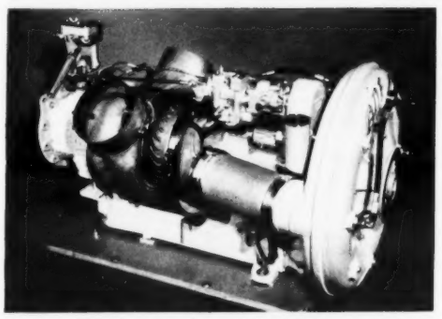
● Finally, the **Pratt & Whitney Aircraft Division,** East Hartford, Connecticut, of *United Aircraft Corporation,* will display cutaway models of the JT-12 jet engine (3,000 lb. thrust), the JT-3D turbofan model of the J57, and the powerful JT-4 (civil version of the J75). For the first time official figures for the JT-4's power have been announced: the present version delivers 15,800 lb. of thrust, while a new version has a thrust of 16,800 lb.

3. Equipment manufacturers

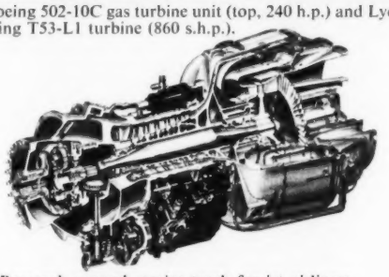
● **Bendix Aviation Corporation,** Detroit, Michigan, intends to display a wide range of its products. The exhibit is planned to illustrate the diversity of the Corporation's research and production facilities and its contribution in both the military and civil aspects of the aviation industry. This cross section will cover radar and electronic equipment, gyro mechanisms, autopilot and flight director systems, together with purely mechanical exhibits such as nose-wheel steering system, brake assemblies and anti-skid devices. A particular feature of the display is to be a "weather bureau" operated from a weather tracking radar installation mounted on the exhibition building.

● **Collins Radio,** Cedar Rapids, Iowa, will feature the new Collins lightweight communications, navigation and flight control equipment. Particular emphasis is being placed on flight directors and control equipment and it is intended to show the FD 105 Integrated Flight System in an operating dynamic demonstrator. The static displays will include commercial VHF communications systems, VOR and localizer receivers, glide slope and marker receivers and a newly developed ATC transponder. Instruments on display will include the 331 H-1 Course Selector Indicator (VOR navigation) and the 332C-1 Radio Magnetic Indicator and also a variety of antennas for various applications.

● **Hughes Aircraft Company,** Culver City, Calif., will show details of FRESCANAR, a frequency scanning

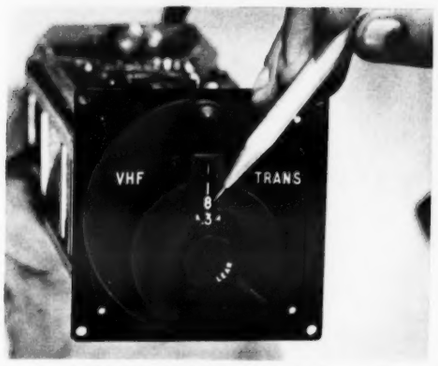


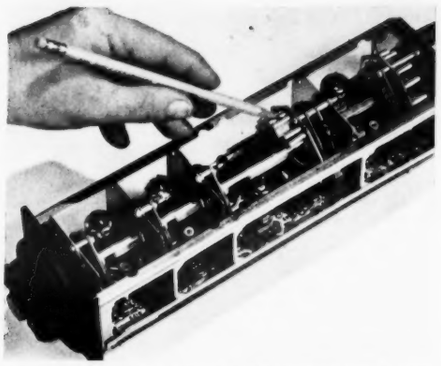
Boeing 502-10C gas turbine unit (top, 240 h.p.) and Lycoming T53-L1 turbine (860 s.h.p.).



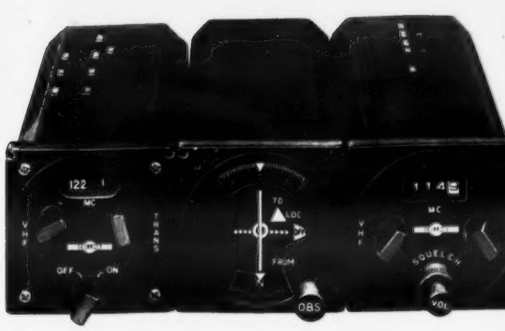
AiResearch ground service truck for jet airliners.

Components of the automatic Position and Homing Indicator (PHI), developed by Computing Devices of Canada, and manufactured and sold by Bendix.





Lear is exhibiting its NAVCOM 100 VHF transmitter (left) with digital tuning for 90 channels. Righthand picture shows the crystal installation.



Collins lightweight 17L-8A VHF transmitter (left), 344D-1 VOR LOC indicator (centre), and the SIX-3 VHF receiver (right).

mobile radar system at present undergoing field tests with the U.S. Army Signal Corps. This is a mobile three-dimensional radar system. It is housed in three trailers; antenna trailer, radar equipment van and power trailer forming a completely self-contained unit for this advanced radar system. Also on show will be other items from the company's range including 21-in. Typotron(R) electron tubes, semiconductors, diodes, silicon rectifiers, capacitors and transistors.

● **Lear Inc.,** Santa Monica, Calif., is showing its latest developments in automatic flight controls, radio navigation and communications equipment. Its range covers equipment for all types of aircraft whether private, executive or transport. Also on show will be a simulator for the Lear Integrated Flight Equipment (LIFE) on which visitors will be able to carry out a complete simulated ILS approach. A Cessna 310 will also be available during the show for actual flight demonstrations of the LIFE system.

● **Nortronics Division** of the Northrop Corporation, Hawthorne, Calif., will exhibit its Take Off Monitor System (TOMS), a ground-based monitoring device at present under study and investigation (described in *Interavia* No. 12, 1958). Other exhibits will include VIPS (Verbal Interruption Priority System), i.e. a small twelve-channel recorder-playback activated by a series of sensors located throughout the aircraft. These sensors report failures such as stuck landing gear, power failure, stall warning, by operating the appropriate pre-recorded channel which feeds the verbal warning directly into the pilot's headset.

● **Hamilton Standard,** Windsor Locks, Conn., a division of United Aircraft Export Corporation, will display cutaway models of fuel controls, starters, pumps, refrigeration and air conditioning systems. The Norden division will display a number of items in the computer and electronic fields.

Canadair-Convair 540 commercial transport (two Napier *Elands*).

Canadair CL-28 naval reconnaissance aircraft (four Rolls-Royce *Tynes*).

Mockup of the Canadair CL-44D long-range transport (four Rolls-Royce *Tynes*).

Canada

Second place in the "New World" is taken by *Canada*, a member of the British Commonwealth, with a population of roughly 15,000,000 and an area of 3,846,000 square miles. The country is thus even slightly bigger than the United States—in fact it is the second largest country in the world after the Soviet Union—but is very much less densely populated. Nevertheless the Canadian aircraft industry must be counted among the five leading aircraft industries in the world and until recently—to be exact, until the Canadian Government cancelled the production contracts for the Avro CF-105 *Arrow* supersonic long-range fighter in March 1959—employed around 50,000 workers, for annual sales in the region of $500 million.

Of Canada's three large aircraft manufacturers—Avro Aircraft, Canadair Ltd., de Havilland Aircraft of Canada—the first mentioned has not yet recovered from the blow and disappointment of losing the contract for its main product, the CF-105, and has cancelled the arrangements it had made to rent exhibition space at the Paris Show. Secondly, de Havilland Aircraft of Canada will probably be represented on the stand of its British sister organization.

Thus Canadian attendance this year will be limited to the very active company of **Canadair Ltd.,** Montreal, Quebec, a subsidiary of the mighty **General Dynamics Corporation,** and to **Canadian Applied Research Limited,** a medium sized equipment manufacture.

Canadair is showing scale models of its main products: the Convair 540 (with two Napier Eland propeller turbines of 3,500 h.p. each) for 48/58 passengers, the CL-28 Naval reconnaissance aircraft (four 3,700 h.p. Rolls-Royce Tyne propeller turbines), the CL-44D long-range commercial transport (four 5,730-h.p. R.-R. Tynes) for up to 167 passengers or 30 tons of freight, and the CL-41 jet trainer (one Pratt & Whitney JT-12).

Canadian Applied Research Ltd.'s main exhibit, on the stand of its French representative *Compagnie Crouzet*, will be the new ANADAC dead/reckoning system, a detailed description of which is published elsewhere in this issue.

Paris Preview

The United Kingdom in Paris

By Derek Wood, Interavia's London Editor

Short Brothers: The SC.1 VTOL research aircraft powered by five Rolls-Royce RB.108 engines making its first free vertical take-off.

United Kingdom

The British contribution at Paris grows Show by Show, and in 1959 there will be more U.K. manufacturers with a greater diversity of equipment than ever before—thus underlining the growing importance of the European market, both civil and military.

No less than 49 U.K. concerns will be exhibiting, including 15 airframe manufacturers, seven engine companies and five constructors of guided weapons.

In the past, most of the new developments were kept for the Farnborough show in September, but this year many items at Paris will be on show for the first time.

The Royal Air Force will have a *Hunter* and a *Javelin MK. 7* in the static show for the week, and for the flying display on the final weekend the famous 111 Squadron *Hunter* aerobatic team will perform, together with a flypast of the three "V" bombers *Victor*, *Vulcan* and *Valiant* representing Britain's atomic deterrent strength.

Since the 1957 exhibition, the face of the British aircraft industry has changed considerably, and emphasis has shifted from military to civil. Two years have seen a great degree of rationalization, with the amalgamation of Bristol Aero Engines and Armstrong Siddeley to form Bristol Siddeley; the emergence of the Hawker Siddeley Aviation Ltd. and English Electric Aviation Ltd.; and the formation of the Airco Consortium to build the D.H. 121 airliner.

● **Hawker Siddeley Aviation** will have a joint stand covering aircraft, missiles and equipment for their member firms, Armstrong Whitworth, A.V. Roe, Hawker and Gloster.

The group's latest aircraft, the Armstrong Whitworth *Argosy*, will be shown statically and flying, and various model layouts on the stand will show loading facilities etc. The *Argosy* seems set for a long career, as it is already on order as standard equipment for Transport Command and has been ordered for civil freight use by Riddle Airlines in the U.S.A.

Armstrong Whitworth's missile contribution will comprise a complete *Seaslug* ship-to-air missile in a ship-type double barrel launcher. The associated companies on the project, Sperry and GEC, will have booths alongside the various *Seaslug* components.

Another Hawker Siddeley Group member, High Duty Alloys Ltd., will have as the centre-piece of their stand four large forgings manufactured for the Hispano Suizo undercarriage fitted to the *Caravelle*. These are all die forgings in Hiduminium RR 77. Other items are examples of special forging processes which have not been shown in Paris before. There will be "draftless" forgings and components produced originally as castings but now as forgings. By the process developed, it is possible to produce "form" on all six faces of a cube. This development has reduced machining times and in the case of a forging there is a more homogeneous structure than in a casting. Another product is specially processed sheet, including two components manufactured by the Bristol Aeroplane Co. Ltd., in Hiduminium 66.

A. V. Roe, now entering the civil market, will have for the first time a $^1/_{12}$ scale model of the type 748, a DC-3 replacement with two *Dart* engines. The 748 should be flying before the end of 1960.

The *Vulcan* bomber will be in scale model form carrying the Avro *Blue Steel* stand-off bomb, which is rocket-powered and inertially guided to its target several hundred miles distant. *Blue Steel* is standard equipment for both *Vulcan 2* and *Victor 2*.

In the static park Hawker will have the *Hunter* two seater, complete with its whole range of external stores. Recently, the *Hunter* was chosen as the ground attack aircraft for the RAF to replace the *Venom*, thus adding to its wide range of duties with British and many foreign air forces.

A.W.A., A.V. Roe, and Gloster will also show electronic, electric, hydraulic and pneumatic components on the stand.

● **English Electric Aviation** will fly the P. 1B *Lightning*, while a *Thunderbird* ground-to-air missile will be in the static park. On the stand will be a variety of guided weapon equipment, and the firm may reveal new developments in the missile field—security permitting.

Other members of the English Electric Group, Napier and Marconi will have stand displays. Napier will have the FAA and ARB approved *Eland 504*, while the *E. 229 Eland* will be flying in the *Westminster* helicopter prototype. The rear compressor *Eland* is installed on the *Rotodyne*, which will also be flying. The production *Westminster* will have the E. 211 *Eland* of 3,500 s.h.p.

Other exhibits will include a sectioned *Gazelle* of the type fitted on the *Wessex* and Bristol 192; *Scorpion, Double Scorpion* and *Triple Scorpion* rocket engines; the Napier rocket-boost system for helicopters; lost wax castings; and Spraymat exhibits. A larger selection of Spraymat units will be included on the stand of Bronzavia, the French licencees for the Spraymat system.

Four major items will be included from the Marconi range: the single-channel VHF DF type AD210C, ADF (radio compass) type AD712, sub-miniature ADF type AD722 and the transistorized airborne teleprinter receiver AD308.

AD712 is the only crystal controlled ADF in the world and it is currently flying as dual installations in all *Comet 4s* and all Hunting Clan *Britannias*. It will also shortly be flying in the *Viscount, Vanguard, Argosy* and Boeing 707.

● Since the 1957 Paris display, the Skyways Group has taken over Edgar Percival Aircraft Co. and is building and marketing the E. P. 9 agricultural and general purpose aircraft under the name of **Lancashire Aircraft Corporation Ltd.** The Lycoming-engined E.P.9 will be demonstrated during the week.

● **Bristol Aircraft** will be represented in the transport aircraft, helicopter and guided weapons fields. Making its first public appearance will be the *Britannia 253* for the RAF, which will take part in the flying display together with the Bristol 192 helicopter (two *Gazelle* engines), also for the RAF.

In the guided weapons park will be a *Bloodhound* ground-air missile together with launcher, limber, loading trolley and launch control post etc.

A. V. Roe & Co. Ltd.: An artist's impression of the new Avro 748 feeder liner equipped with two Rolls-Royce *Dart Mk. 514* engines.

● A newcomer to the Salon is **Bristol Aerojet** who exhibit sustainers and boost rocket motor cases, spherical pressure baffles in steel and plastics, and glass fibre rocket motor cases.

● **Fairey Aviation** will show for the first time a 1/8 scale 65-seater type *Rotodyne* as ordered by New York Airways, and the smaller *Eland*-powered *Rotodyne* will be displayed both statically and flying.

Fairey is the European agent and licencee for the Australian *Jindivik* target, and the MK.2B machine will be in the static park the whole week. In addition there will be mention of the still secret Fairey anti-tank missile which is exceptionally accurate, and examples will be shown of Fairey investment castings.

● **Blackburn Aircraft:** For the first time the Blackburn NA.39 strike aircraft will be on public view for three days. The dimensions of the aircraft can now be released and they are as follows: length 64 ft. 4 in., span 42 ft. 6 in., and height 16 ft. By an ingenious arrangement of folding back the nose and opening the tail dive brakes, a length of only 50 ft. 7 in. is achieved for carrier stowage.

A model of Robert Blackburn's first aeroplane will mark the 50th anniversary of the company, which coincides with the 50th anniversary of the Paris Show.

The Blackburn engine range will cover a standard starter trolley, the A129 free turbine engine, the aircraft auxiliary powerplant as fitted to the *Victor B.2*, and the *Turmo* free turbine engine (Turboméca licence).

● **Folland Aircraft,** now deeply engrossed with the RAF preproduction contract for the *Gnat Trainer*, hope to havea *Gnat MK.1* fighter in the display—flight test programme permitting. On the stand will be 1/4 scale models of the *Gnat 1* and the *Gnat Trainer*, as well as *Gnat* components. At Southampton work continues on the *Gnats* for Finland and India, and 9 *Trainers* out of the 14 ordered are in the shop in various stages.

● **Handley Page Ltd.** will not have a stand, but the *Dart-Herald* feeder liner will be available for inspection and will fly during the display. The *Herald* is at present on a world sales tour.

● **Scottish Aviation** will display the Series 2 *Twin Pioneer* for Phillipine Airlines, which is equipped with Pratt and Whitney R-1340 radials. Latest development in the *Twin Pioneer* range is the Series 3, which benefits in performance, payload and range from the installation of the higher rated Alvis *Leonides* 531/8 of 625 h.p.

● **Short Brothers and Harland:** emphasis will be on the new Short SC.5 *Britannic* heavy freighter, the lightweight *Seacat* ship-air missile and VTO techniques exemplified by the SC. 1.

The four-*Tyne Britannic* and the RB.108 powered SC.1 will be in the form of scale models, the former showing loading facilities. *Seacat*, being essentially a cheap, easy-to-use weapon, is likely to find favour in NATO and elsewhere, and will provide the natural successor to the 40 mm. Bofors gun on land and at sea.

The control system and a typical flight plan for the robot *Canberra V.10* will be illustrated.

● **Vickers-Armstrongs:** The big *Vanguard* turboprop airliner for BEA and TCA will have its debut at the Salon and should be a centre of attraction. No other Vickers aircraft will be shown, but in the weapons park will be the Vickers 891 *Vigilant* man-portable anti-tank missile which was recently tested in the USA, and which may be ordered for the British Army.

● **Westland Aircraft** will show a whole range of helicopters, large and small, including the *Widgeon*, a de Havilland *Gnome*-powered *Whirlwind*, a Naval *Wessex* and the giant *Westminster* flying crane with two Napier *Elands*.

● **Bristol-Siddeley,** the new and powerful aero-engine combine, will have a stand at Paris for the first time. With three big plants and an estimated payroll of 24,000, this company has a major part to play in the European scene.

From Filton will be an *Olympus 201* of 17,000 lb. thrust, as used on the *Vulcan MK2;* the *Orpheus 803* for the Fiat G. 91; the *Proteus 765* turboprop with an overhaul life of 2,000 hours; and the *Thor* ramjet.

From Coventry comes an equally wide range: The *Viper ASV.11* turbojet as used in the *Jet Provost, Jindivik* and Macchi MB.326, the *Sapphire SA.7R* with limited reheat giving a total of 12,230 lb. thrust, the new P.181/182 turboshaft/turboprop engines, the *Gamma 201* rocket as used on *Black Knight*, the PR.23 lightweight rocket motor and a gas turbine compressor unit.

● **Rolls-Royce,** the largest producers of aero gas turbines in the West outside the USA, will have the *Conway RCo.10* turbojet, the *Avon RA.29* as fitted to the *Comet 4* and *Caravelle*, the RA.24R with reheat which is the power plant of the English Electric *Lightning*, the *Tyne* turboprop (for the *Vanguard, Britannic*, CL-44, *Rotodyne*, the Breguet 1150 and the new Franco/German military freighter).

On the stand will also be *Dart* components which have achieved very long life in airline service.

● **Alvis** of Coventry continue to manufacture large quantities of *Leonides* and *Leonides Major* radial engines which are used in a wide variety of fixed-wing and helicopter applications. On the stand will be the *Leonides 531*, the new 550 version, and the *Leonides Major* types 702/1 and 755/1.

● **De Havilland Engines and de Havilland Propellers Ltd.** will share a stand. The engine company's prime exhibit will be the first *Gnome* turboprop engine of 1,000 h.p. This unit is already scheduled for the Breguet 941, while the turboshaft version (also on show) is installed on a *Whirlwind* and in triple installation form will power the Agusta AZ.101D helicopter. A production version of the *Gyron Junior DGJ.1* will be on view; this type of engine powers the Blackburn NA.39 strike aircraft.

De Havilland Propellers will display the *Firestreak* infra-red air-air missile which is now going into service with the RAF, and an 11 ft. propeller, incorporating the latest techniques, for the *Gnome* engine.

*

An exceptional range of *British materials and aircraft equipment* will be demonstrated at Paris, and a large proportion of the items form standard equipment on Continental-built aircraft.

Armstrong Whitworth Aircraft Ltd.: The AW.650 *Argosy* civil freight and passenger transport, fitted with four Rolls-Royce *Dart 526* engines.

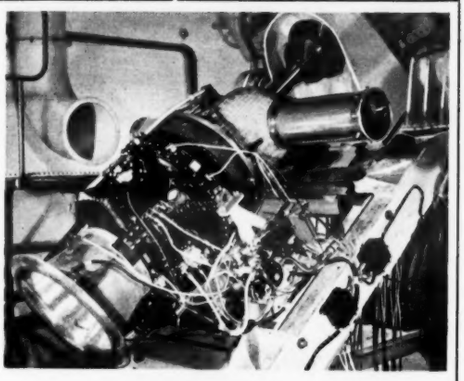
Westland Aircraft Co. Ltd.: The *Westminster* helicopter—two Napier *Eland 229 A* engines.

Lancashire Aircraft Corp. Ltd.: The E.P.9 (Edgar Percival) is adaptable for a wide range of duties, both military and civil.

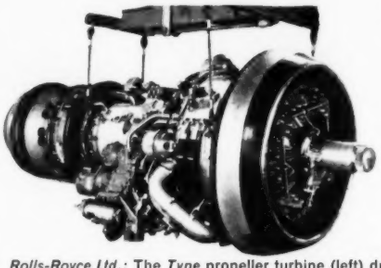
De Havilland Engine Co. Ltd.: The *Gyron Junior DGJ.1* giving 7,000 lb. thrust. An air bleed manifold is fitted round the combustion chamber to supply air for aircraft high lift devices.

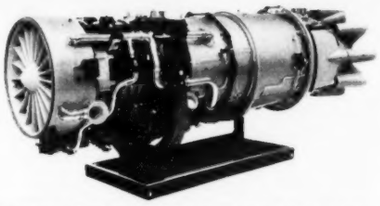
Blackburn Aircraft Ltd.: The NA.39 Naval strike aircraft powered by two de Havilland *Gyron Junior* engines, now in production for the Royal Navy. The main dimensions have now been released: span 42 ft. 6 in., length 62 ft. 4 in., max. height on ground 16 ft. For carrier stowage the folded dimensions are span 20 ft., length 50 ft. 7 in., height 16 ft. 7 in.

Some British Engines

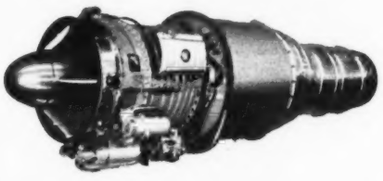


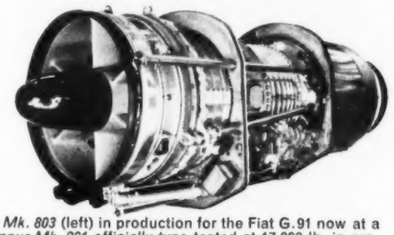
Bristol Siddeley Engines: The P.181 on test. A small turboshaft engine specifically designed for rotorcraft applications.



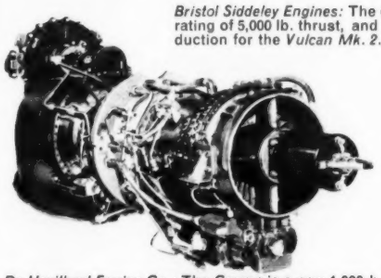


Rolls-Royce Ltd.: The *Tyne* propeller turbine (left) due to enter service at ratings of 4,985, 5,525 and 5,730 t.e.h.p., and the *Conway RCo. 10* by-pass turbojet of 16,000 lb. guaranteed minimum thrust.

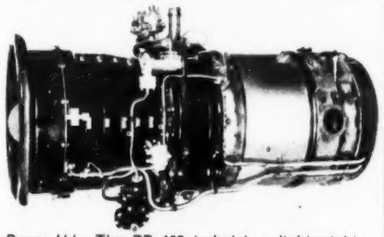




Bristol Siddeley Engines: The *Orpheus Mk. 803* (left) in production for the Fiat G.91 now at a rating of 5,000 lb. thrust, and the *Olympus Mk. 201* officially type-tested at 17,000 lb. in production for the *Vulcan Mk. 2*.

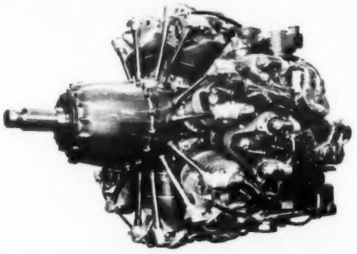


De Havilland Engine Co.: The *Gnome* is a new 1,000-h.p. turboshaft unit with reduction gearing.



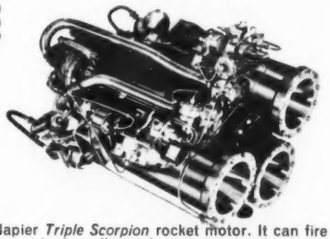
Rolls-Royce Ltd.: The RB. 108 turbojet, a lightweight engine specially designed for jet lift.

D. Napier & Son Ltd.: The *Eland E.211* engine as developed for the Westland *Westminster* helicopter.



Alvis Ltd.: The *Leonides Major* engine for fixed wing applications. Max. power rating 885 b.h.p.

D. Napier & Son Ltd.: The *Gazelle* free turbine engine was designed primarily for helicopters. It has power ratings from 1,260 to 2,000 shaft horsepower and can be installed in any position from the horizontal to the vertical.



The Napier *Triple Scorpion* rocket motor. It can fire its chambers singly, collectively or in any combination and can be stopped and restarted any number of times at any altitude.

The *Rotax* stand will cover both *Rotax* and *Joseph Lucas* (Gas Turbine Equipment) Ltd. equipment. Lucas fuel system and combustion equipment for aircraft gas turbines will include sectioned and complete units exhibited in the form of typical engine fuel systems for such power units as the Rolls Royce *Dart, Avon* and *Conway*, and the Bristol *Orpheus*. A quick release coupling on view is for use in aircraft hydraulic, fuel and oil systems which may be readily connected or disconnected by a simple one-hand movement without tools of any kind.

Since they first made their appearance some ten years ago, transistors have quickly reached a stage where they can be considered for many commercial and service applications such as static transformers and static d.c./a.c. inverters. The present Rotax range on show covers the development of 400 c.p.s. three-phase and single phase units at 115 volts output, working from 24—28 volts d.c. input.

Other Rotax exhibits will include a flashing warning lamp weighing 4½oz., a transistorised navigation lamp flasher unit; a pneumatic starter for gas turbines: a ram air turbo-alternator unit to provide emergency power for an aircraft in which the main power supply has failed, and a 40 KVA brushless alternator.

Electrical power systems for aircraft is the theme of the *British Thomson Houston Co.* stand. The equipment represents a single channel from a variable speed a.c./d.c. power system. Each channel is capable of delivering 350 amperes at 28 volts d.c. from the silicon rectifiers over a generator speed range of 3 to 1. This system is as used on the de Havilland *Comet 4*.

Folland Aircraft: A twelfth-scale model of the *Gnat* two-seat transonic trainer. A pre-production development batch of 14 is under construction for the Royal Air Force. It will be powered by a derated *Orpheus BOr.4* which is now undergoing tests at Filton.

Other individual items cover high energy ignition units, d.c. motor units, miniature switches, a control switch, and an oil pressure switch.

Murphy Radio Ltd., will feature the Leader Cable Equipment and Automatic Landing, and their display at the Salon will be principally built around this, plus the airborne tape reproducer MR 380, passenger announcement equipment, *Rebecca MK8 and 8B*, transportable radio beacon, VHF multi-channel aircraft equipment, VHF mobile R.T. and several other units.

Items from the *E.M.O. Instrumentation Ltd.* range include a torque testing machine, a bearing washing machine, and precision bearings.

Avica Equipment Ltd. has supplied material for practically all aircraft and engines presently built in the U.K. At Paris they will have stainless steel flexible pipe assemblies, stainless steel bellows assemblies, swivel pipe couplings, rigid tube couplings, support clamps, flexible fuel line couplings, Avica "on mark" quick disconnect couplings, and synthetic rubber flexible assemblies.

H. M. Hobson Ltd. will have 20 different units at Paris, including a fuel flow proportioner, feel simulator units for the *Britannia*, a flap control unit for the

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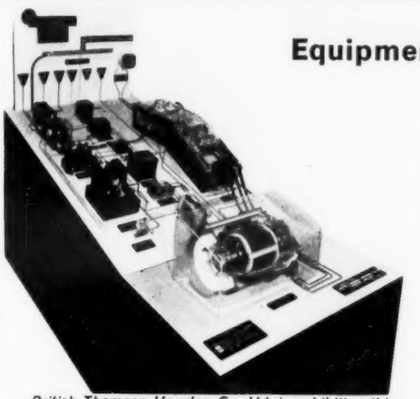
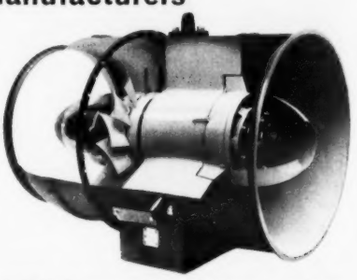
REVIEW OF WORLD AVIATION

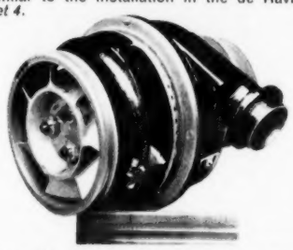
Equipment Manufacturers



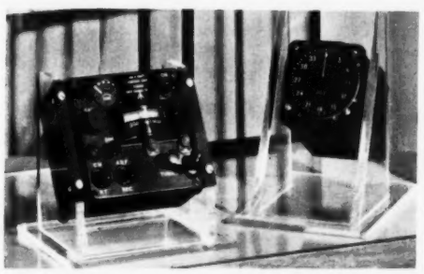
British Thomson-Houston Co. Ltd. is exhibiting this display of an aircraft power supply system. This is similar to the installation in the de Havilland *Comet 4*.



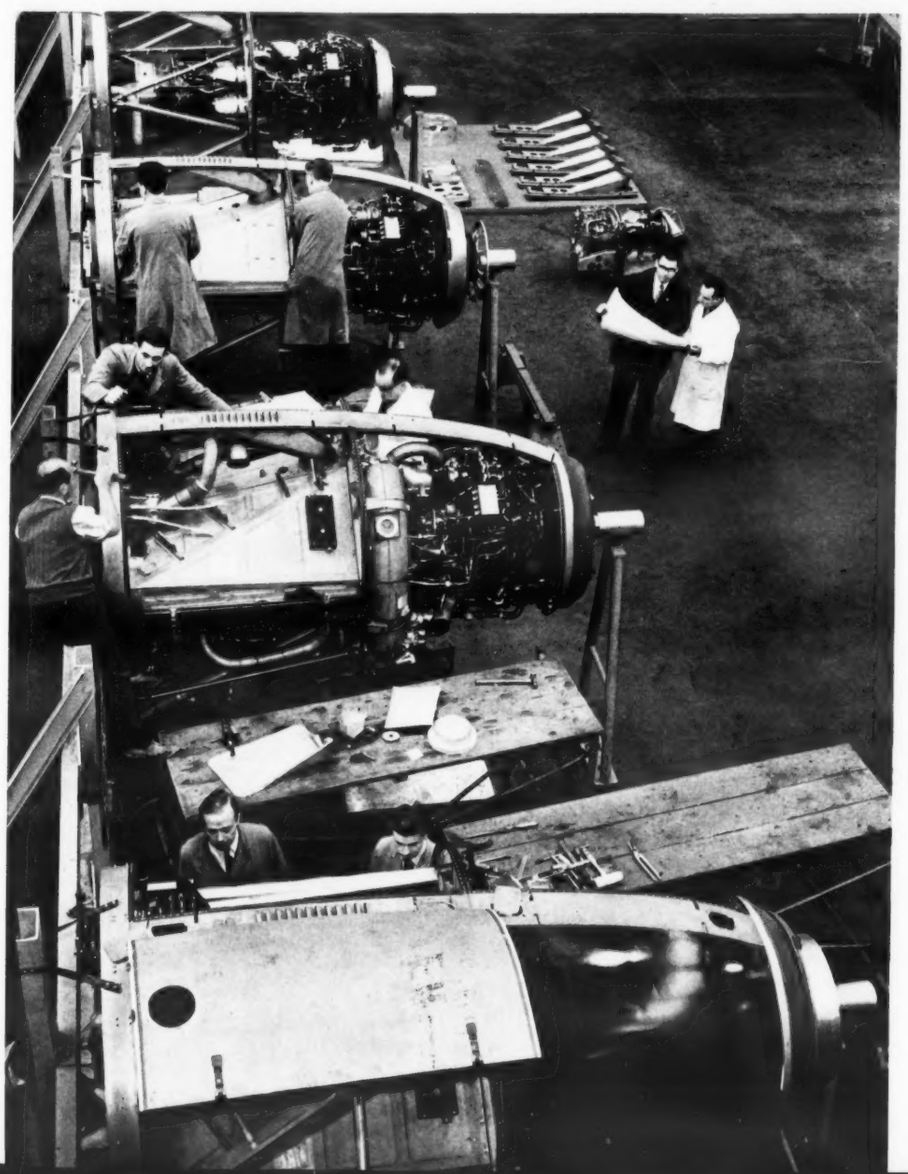
Rotax Ltd.: A ram-air turbo alternator to provide emergency power in the event of failure of the aircraft main supply.



Normalair Ltd.: This company has a wide range of products on show including this 16-mm cooling turbine.



Marconi Ltd.: The receiver remote control unit and bearing indicator of the Marconi Type AD 722 Subminiature Automatic Radio Compass.



Argosy, camber flap control and feel simulator units for the *Caravelle*, float chamber carburetter for the Potez 6D-00 engine, power flying controls for the *Gnat* and hydraulic pumps, etc.

Normalair Ltd., together with its Canadian and Australian subsidiaries, will present a combined display, the theme of which is the company's ability to provide complete systems for aircraft pressurization, air conditioning, and oxygen equipment. The variety of equipment to be displayed will emphasize the company's position as Europe's largest producer of aircraft cabin air conditioning systems and components. Units used in the following types of systems will be on show: pressure control systems, pneumatic flow control systems, pneumatic temperature control systems, electric temperature control systems, electro-pneumatic temperature control systems, air cycle cooling systems, vapour cycle cooling systems, oxygen systems, liquid oxygen systems.

Heat exchangers are a speciality of *Delaney Gallay Ltd.*, who will have exchangers on view for *Vanguard, Viscount* and *Britannia* wing de-icing, an exchanger for secondary surfaces on the *Herald, Dove* and *Gnat*, various oil coolers, a heat shroud, exhaust collector, insulated ducting and a toilet unit and cabinet.

On the *C.T. (London) Ltd.*, stand will be a joint exhibit by Cossor Radar and Electronics Ltd., Mechanism Ltd., and W. Vinten Ltd.

An aneroid barometer for airport towers and weather stations will be shown by *Mechanism Ltd.*, together with an airspeed indicator, stand-by airspeed indicator, stand-by altimeter, power loss indicator, fatigue load meter, accelerometer strain gauge recorder, strain gauge transmitter, machmeters and switches etc.

Cossor will feature their airborne secondary radar system type 2A. A major feature of the system is the "side lobe" suppression technique, preventing responses from the aircraft other than those caused by interrogations from the main directional lobe of the ground aerial. This, together with the use of separate ground-air and air-ground frequencies, ensures that the display is free from unwanted and confusing indications.

W. Vinten, who have specialised in photographic equipment for 50 years, will display the F.95 70 mm reconnaissance camera, G.90 16 mm combat recording camera and the 35 mm geological survey camera.

The Dowty Group will have a joint stand for their subsidiaries Dowty Equipment, Dowty Fuel Systems, Dowty Nucleonics, Dowty Seals and Rotol Ltd.

Among the Dowty aircraft undercarriages will be those for the *Lightning, Argosy, Friendship*, and *Gnat*. Other items cover fuel systems, "Moog" servo valves, hydraulic pumps and motors, accessory drive gear boxes, ram air turbines, constant speed drives, turbo alternators, a variety of aircraft electrical equipment and standard and special section seals.

Rotol will have an 11 ft. 6 in. propeller for the *Argosy*.

Sir George Godfrey and Partners' cabin supercharger is fitted to all *Viscounts, Friendships*, the *Herald, Argosy* and *Gulfstream*. This will be displayed together with a cabin compressor, cold-air units, valves, typical water extractor and two industrial blowers used in ground equipment.

Harley Aircraft Landing Lamps will have the model 'T' mobile floodlight and 12 varieties of landing lamps for fixed wing aircraft and helicopters.

Martin-Baker's latest type ejection seat will be displayed on the Hispano Suiza stand, while C.I.B.A. (ARL) Ltd. will have applications of the Redux metal-metal adhesives and honeycomb material as used on *Argosy, Vanguard, Comet 4, Friendship* and *Alouette*.

Other British manufacturers at Paris will be *Lodge Plugs* with sparking plugs, gas turbine igniters and industrial ceramics; *Decca Navigator Co.* with Decca Mk. 10 equipment on the stand of SFR; *Henry Wiggin Ltd.* and *Garringtons*.

D. Napier & Sons Ltd.: Eland powerplants in production at Luton. These engines are destined for Canada where they will be installed in Canadair CL-66s for the Royal Canadian Air Force (military version of the CV-540).

Paris Preview

An ABC of the European Exhibitors

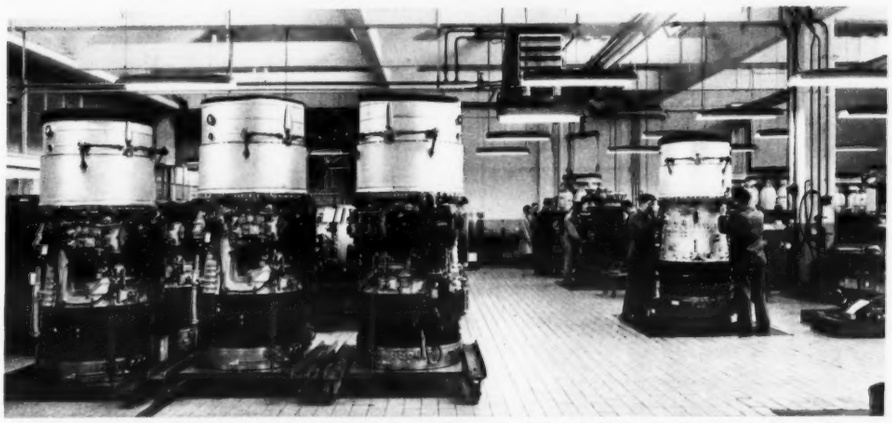
The fact that seven European exhibiting countries have been grouped together in one article below in no way indicates a lack of appreciation for their substantial contributions to international aviation. The "grouping" has been necessary purely for space reasons. Individual countries have been arranged in alphabetical order in their national language.

Belgique - Belgium

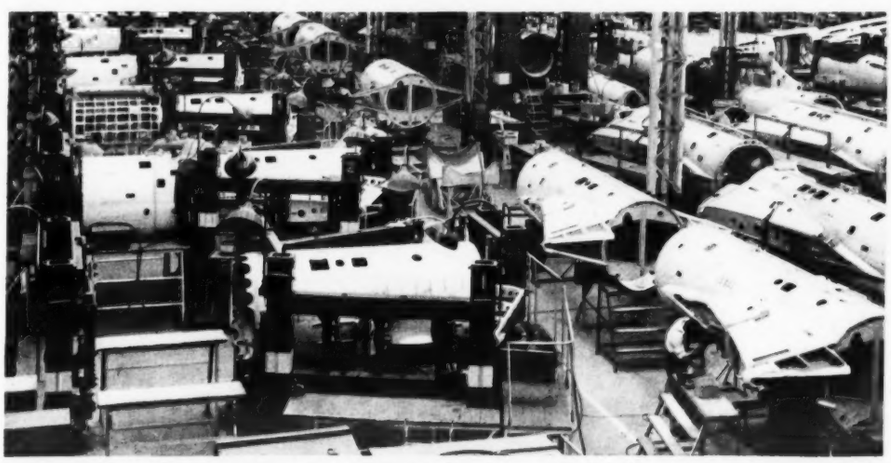
Belgium does everything that lies in its power for its Air Force and its aircraft industry. In the ordinary Belgian defence budget for 1959, out of a total of 13,000 million Belgian francs ($260 million), the sum of 7,300 million francs is earmarked for the Army, 4,400 million for the Air Force, and 500 million for the Navy. The extraordinary defence estimates total 6,300 million francs, of which the Air Force is to get 1,100 millions. What is more, the Parliamentary Defence Committee has approved the extra appropriation of 3,000 million requested by the Government for the development of missiles during the next ten years.

*

That the Belgian Government does not always find it easy to prize loose the essential funds needed by the aircraft industry is revealed by the hearings held at the end of April before the Senate Defence Committee, when one Senator declared, unabashed: "The financial burden of constantly renewing our air fleet is beyond our country's capacity . . . Would it not be better to maintain well-equipped land forces, rather than an Air Force whose equipment will always be obsolescent? . . . Of course, we need reconnaissance aircraft and transports, but manned fighters are now out of date." To which the Defence Minister replied: "Are we really to sacrifice the whole or part of our Air Force, as certain circles propose? This would, of course, be possible, but it would appear to be to be a premature move . . . We cannot leave our skies without defence. As the anti-aircraft artillery cannot at present provide this defence, we must have fighters . . ."



Quantity production of the *Avon* jet engine (Rolls-Royce licence) at Fabrique Nationale d'Armes de Guerre, Herstal.



Quantity production of the Hawker *Hunter* airframe at Avions Fairey S.A., Gosselies.

Fairey *Tipsy Nipper* sports single-seater, with 30 h.p. Volkswagen engine.

Stampe & Renard SR. 7 *Monitor* sports two-seater, with 180 h.p. Blackburn *Cirrus Bombardier*.

Type R.278 receiver, from Ateliers de Constructions Electriques de Charleroi (ACEC).

Overhaul work on the U.S. Army's Sikorsky S-58 helicopters at S. A. Belge de Constructions Aéronautiques (SABCA) Haren, near Brussels.

What is the nature of the aircraft industry which is behind these defence efforts and which is planning to exhibit its products in Paris?

Belgium has five manufacturing companies in the aviation field: Avions Fairey S.A.; SABCA (Société Anonyme Belge de Constructions Aéronautiques); Stampe & Renard S.A.; ACEC (Ateliers de Constructions Electriques de Charleroi) and Fabrique Nationale d'Armes de Guerre S.A.

These companies are all members of the Groupement Belge de Constructeurs de Matériel Aéronautique (GEBECOMA for short), and will occupy a joint stand at the Paris Air Show.

Fabrique Nationale d'Armes de Guerre (F.N.), of Herstal, set up an aircraft engine division, with the technical assistance of Rolls-Royce, in 1948. Since production of the Hawker *Hunter*—for which F.N. built the *Avon* engines under licence—has been phased out, the company is at present restricted to maintenance and overhaul work, and to the production of spares: maintenance of the *Orenda* engines for NATO's CF-100 fighters, of the Turboméca *Marboré IIs* for the Belgian Air Force's Fouga *Magister* trainers, and of *Avon* engines for the *Hunter*.

SABCA, of Brussels-Haren and Gosselies-Charleroi Airport, was founded in 1920, but its plants were completely destroyed in World War II. After reconstruction it first turned to licence production of wings, undercarriages and hydraulic systems for the *Hunters* destined for the Benelux countries. Since 1952 it has also been manufacturing accessories for the Belgian, Dutch, French and U.S. Air Forces. Other activities include maintenance and overhaul work (hydraulic and electronic equipment, aircraft instruments, undercarriages).

Similarly, **Avions Fairey S.A.,** at Gosselies Airport, a subsidiary of Britain's Fairey Aviation Co. founded in 1931, which employed roughly 1,000 persons in 1958, has been virtually limited to maintenance and overhaul work for NATO since the end of Hunter production: Republic F-84 and Hunting *Pembroke*. The company will be showing its small *Nipper* sports and touring aircraft both on the ground and in flight at Paris.

Stampe and Renard, Brussels, has made itself a name, particularly in French-speaking countries, through the manufacture of its sports and training aircraft (*Monitor*, SV-4).

There remains, finally, **Ateliers de Constructions Electriques de Charleroi,** who supplies aircraft instruments and equipment for the SABCA and Fairey aircraft and maintains eleven plants manufacturing electrical, electronic and nuclear equipment in Belgium and other countries.

*

The Belgian aircraft industry has a total plant area of nearly 5,000,000 sq.ft. and employs a total personnel of 3,600 engineers and more than 30,000 skilled workers. If rational use of the Belgian production resources is to be ensured, both European and non-European manufacturers should avail themselves of their valuable services.

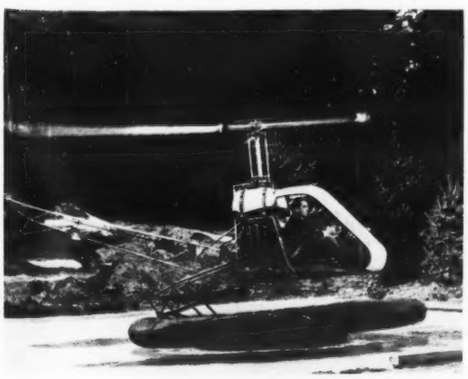
Bundesrepublik Deutschland - Federal German Republic

The young German aircraft industry already has a full article devoted it in the present issue ("The 1959 German Air Show, Hanover", on p. 702, etc.), so that there is no need here to list the original designs of the major manufacturers. And an issue devoted primarily to the Paris Show is not the place to discuss the licence production of foreign military equipment now getting under way in the Federal Republic. All that remains, therefore, is to describe the new designs which three South German companies are taking to Paris.

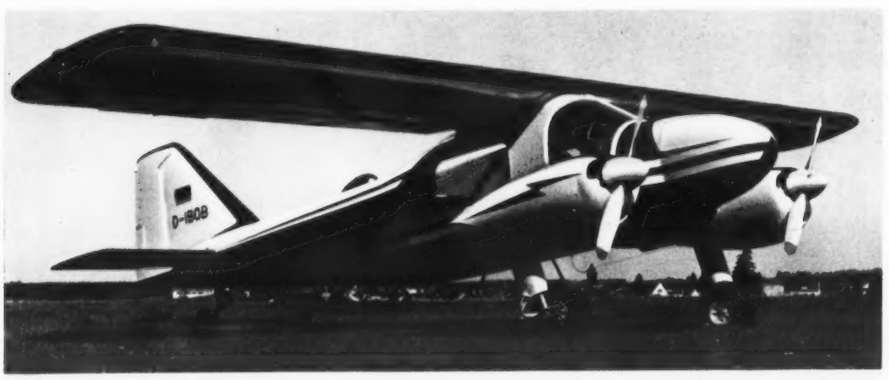
Dornier-Werke GmbH will be showing its new Do 28 twin-engine touring aircraft (two 180 h.p. Lycoming engines) to a wider public for the first time. Despite its cruising speed of 135 knots, the four-to-six-seat Do 28, which made its first flight at Dornier's Munich-Neuaubing airfield on April 29th, 1959, must be described as a short take-off aircraft; its wing has the same lift devices which have proved their worth in the Do 27. This twin-engine model will probably also soon figure on the Dornier export list, along with newer versions of the Do 27.

Bölkow-Entwicklungen KG, a company which outside Germany is known virtually only in trade circles, will be showing a selection of its ambitious development and production programme, including the 810 *Cobra* anti-tank missile, a new-type training device, with television target display, for training anti-tank missile operators and simulating missile movements, the *Heli-Trainer Bö-102* (a helicopter training device developed to a design of Captain Hoffmann) with

The *Heli-Trainer* Bö-102 developed by Bölkow-Entwicklungen KG (Germany), with 40 h.p. Ilo engine and pontoon base.



The Dornier Do 28 short take-off aircraft for 4 to 6 persons has two 180 h.p. Lycoming engines and v.p. propellers; cruising speed is 135 knots, and range 700 nautical miles.

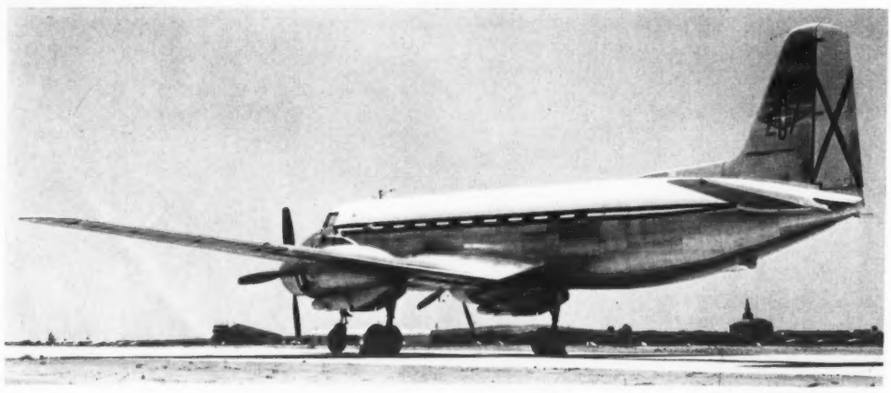


L.200 *Morava* touring aircraft; two 210 h.p. M.337 engines.

L.60 *Brigadyr* multi-purpose aircraft; 220 h.p. Praga *Doris* engine.

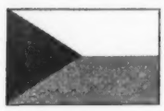
L.40 *Meta Sokol* touring aircraft; 140 h.p. M.332 engine.

CASA-207 *Azor* commercial transport for 30 to 40 passengers, built by Construcciones Aeronáuticas S. A.; two 2,040 h.p. Bristol *Hercules 730*.



40 h.p. Ilo engine, and finally the Klemm Kl 107 B is the responsibility of a subsidiary, Apparatebau Nabern GmbH, which also produces the *Heli-Trainer*, the *Cobra* missile and its accessories.

Among electronic firms, mention should be made of **Standard Elektrik** Lorenz AG, which will occupy a joint stand with its sister companies, Le Matériel Téléphonique, Paris, and Fabbrica Apparecchiature per Comunicazioni Elettriche Standard, Milan.



Ceskoslovenska Republica - Czechoslovakia

As two years ago, Omnipol, the State foreign trade organization in Prague, will be represented in Paris with a relatively wide range of aircraft, engines and accessories produced by the Czechoslovak aircraft industry. Particular interest is expected to be aroused by the twin-engine L. 200 *Morava* and *Aero 145* touring aircraft, which are as yet but little known in the West, as well as the new Z. 326 *Trener Master* version of the well-known Z. 226 and Z. 126 series of two-seat trainers. In addition the L. 40 *Meta Sokol* sports and touring aircraft, the L.60 *Brigadyr* agricultural and multi-purpose aircraft and finally the L. 13 *Blanik* two-seat all-metal glider will be demonstrated on the ground and in flight. Details and pictures of these models were given in the article on the Czechoslovak aircraft industry in *Interavia* No. 1, 1959. It should be added that the new *Aero 145* is very similar to the *Super Aero* but is powered by two 140 h.p. M-332 four-cylinder in-line engines (the *Super Aero*, of course, has the 105 h.p. Walter *Minor 4-III*). Though weights have been practically unchanged, the higher engine power gives the Aero 145 improved performance: cruising speed is 146 knots, compared with 127 knots for the *Super Aero*, and service ceiling is 18,370 ft., compared with 16,570 ft.

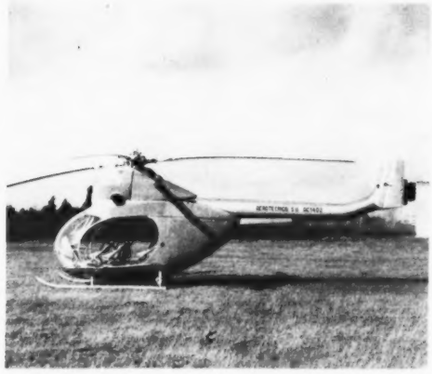
Engines exhibited will include the *M.332* (140 h.p.) as fitted in the Aero 145 and the three-to-four-seat *Meta Sokol*, and the new *M.337* air-cooled six-cylinder in-line engine with supercharger and direct fuel injection, which has a take-off rating of 210 h.p. Two of the latter engines, plus V.410 electrically controllable metal propellers, are fitted for example in the L.200 *Morava*. Omnipol's stand will also show a selection of aircraft instruments, ground test equipment and parachutes.

España - Spain

Two years ago on the occasion of the 22nd Salon International, a Spanish aircraft flew for the first time at Le Bourget and made an excellent impression. This year the Spanish aircraft industry, grouped under Agrupación Técnica Española de Constructores de Material Aeronáutico, will be showing visitors a wide variety of Spanish manufactured aeronautical equipment ranging from a 95 h.p. engine to a transport aircraft, from a twin-jet trainer to the most intricate accessories.

Although the Spanish industry only warrants a modest place among European aircraft exhibitors, it is none the less important. As in other countries the aircraft industry's group of first-class specialists provides an essential lead to other branches of engineering, a lead which is limited only because of credit restrictions.

Hispano Aviación HA.200-R.1 *Saeta* jet trainer (two Turboméca *Marboré IIs*) at the Instituto Nacional de Técnica Aeronáutica's Torrejon de Ardoz airfield.



Aerotécnica S.A.'s AC.14 five-seat turbine helicopter: powerplant, Turboméca *Artouste* of 320 h.p. plus 175 lb. residual thrust.

Spanish manufacture is both appreciated and in demand as demonstrated by USAF contracts for the periodic overhaul of *Sabre* and *Super Sabre* fighters. This work is continuing together with maintenance and repair commitments on behalf of the Air Ministry. The high quality of the Spanish aircraft industries' products is well known outside Spain. The possibility of penetrating the European market would be enthusiastically greeted as it would then be possible (supported by all the available industrial resources) to take on even bigger commitments.

The restriction of credits referred to above has pretty well hamstrung the work of all the aeronautical companies (which are practically dependent upon government orders) and forced them to look into other fields in order to ensure their continued development, if not their bread and butter. Under these conditions manufacturing programmes have been subjected to some degree of diversification (that is, precision machinery, automobiles, machine tools, electronics, etc.) in the civil market, which they are increasingly penetrating. Their specialized techniques and knowhow open up a wide range of possibilities in the non-aircraft field which enable high priced tenders to be submitted and more often than not accepted.

ATECMA groups four principal aircraft engine companies, ten major and thirty-two smaller aircraft equipment manufacturers, the latter mainly concerned with aviation. The specialized workers connected with these concerns number approximately 10,000. The fact that the President of the Association Internationale des Constructeurs de Matériel Aéronautique is today a Spaniard shows the degree of importance attached to aeronautical matters in Spain.

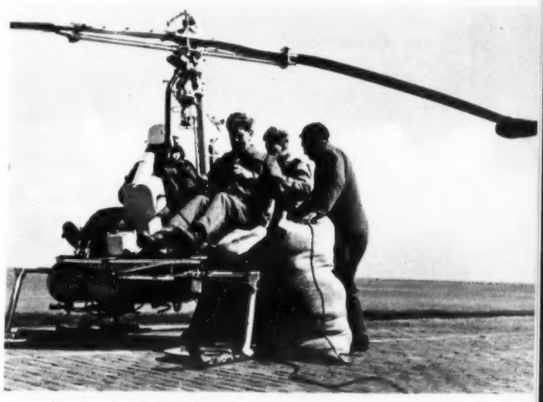
What do the various companies do at the present time? AISA (Aeronáutica Industrial S.A.) has completed the manufacture of a series of light I-11-B aircraft and tandem I-115 trainers. The former aircraft are in use by aero clubs while both models are in service with the Spanish Air Force. In addition to working on twin-engine transport aircraft of its own design—ten of the most recently designed aircraft, the C-207 have been manufactured—CASA (Construcciones Aeronáuticas S.A.) is also building fifty Do 27s under licence. AISA and CASA are both carrying out overhauls of United States aircraft: namely T-6s for AISA, and F-86s and F-100s for CASA who have built a large hangar for this undertaking at Getafe.

HASA (Hispano Aviacion S.A.) devotes itself to the manufacture in small numbers of the HA-100 *Triana* and HA-200 R-1 *Saeta;* design is in progress of a two-engine communications aircraft and the HA-300, a supersonic fighter. Subsequent to a large building programme of piston engines, ENMASA (Empresa Nacional de Motores de Aviación S.A.) undertook the manufacture under licence of the Turboméca *Marboré* turbojet; a plant is being established near Madrid for the overhaul of high thrust turbojet engines.

Aerotécnica is working on its turbine-powered AC-12 and AC-14 helicopters, a number of which are being manufactured with the assistance of various sub-contractors. The larger AC-21 aircraft is nearing completion. Finally, although outside ATECMA, a further company, Aerodifusión of Santander has undertaken important work in the field of light aircraft. Other firms are producing accessories and spares for aircraft and engines, as well as a wide range of materiel required for airports and bases, air traffic control, radio navigation, and armament equipment.

It is possible that the Spanish aircraft industry is not fairly appreciated, in any case, its 10,000 workers (500 of which are talented engineers and technicians), over 3,000,000 sq.ft. of working area (300,000 m²) with an estimated value of 1,000,000,000 pesetas (approximately $15,000,000) are sufficiently significant figures for due recognition to be given to the place occupied by Spain in the European aircraft industry.

H.3 *Kolibrie* ramjet helicopter, designed by Nederlandse Helicopter Industrie, engaged in agricultural duties...



...and preparing for these tasks.

Some sixty F-27 *Friendship* turboprop transports (two Rolls-Royce *Darts*) have so far been ordered from the Fokker works by airlines, private companies and the Netherlands Air Force.

Fokker F-27 *Friendship* turboprop airliner (two Rolls-Royce *Darts*) in the colours of Norway's Braathens SAFE.

TS-8 *Bies* military trainer (Poland) with 320 h.p. Narkiewicz WN-3 engine.

Nederland - The Netherlands

The story of the Netherlands aircraft industry goes back to 1910, when Verwey and Lugard, two car dealers from The Hague, bought a plot of waste land near the village of Soesterberg and turned it into an airfield for public flying demonstrations, flying training and the construction and maintenance of aircraft. Canteens for the "aviators" and a restaurant for spectators were built, and "Vliegkamp Soesterberg" was prepared to serve as terminal for the third lap of the European "Tour de l'Air" in 1911. The same year Frits Koolhoven, one of the Netherlands pioneer aircraft designers (in the thirties he was Managing Director of Koolhoven's Aircraft Factory at the former Waalhaven Airport), designed and built his first aircraft, the Koolhoven FK-1 "Heatherbird", at Soesterberg.

During World War I Soesterberg was taken over by the Aviation Department of the Netherlands Army and became a military base—which it has remained to this day. Aircraft construction during the war years was concentrated at the Netherlands Aircraft Factory Trompenburg, at Amsterdam, a sister company of the well-known Spijker car manufacturers. The joint company was under the management of Henri Wijnmalen, another Dutch flying pioneer and winner of the Paris–Brussels flight. The factory turned out Farmans assembled from belligerent aircraft forced down or lost over Holland, as well as building Nieuport fighters (with 80 h.p. Thulin rotary engines) under licence. In 1917 it also produced 56 *Spijker* trainers of its own design.

After World War I a new era opened, with greater emphasis on civil aviation. Anthony Fokker, who had become famous for his aircraft design work in Germany (his Fokker D-VII, incidentally, is still on show at the Hotel des Invalides, Paris, and in the National Aeronautical Collection of the Smithsonian Institution, Washington), returned to Holland and established the Koninklijke Nederlandse Vliegtuigenfabriek Fokker at Amsterdam in June of 1919. The company is thus celebrating its 40th anniversary this year.

From that time onwards Fokker became the leading aircraft manufacturer in the Netherlands and, in the twenties, one of the world's leading manufacturers. His F-VII 3m, after having successfully flown from Amsterdam to Batavia (Jakarta), Java, in 1924, raced to fame in the United States Ford National Reliability Tour in 1925 (soon nicknamed Fokker's Publicity Tour).

After World War II, when a gigantic aircraft industry had been built up in other parts of the world, the situation of the Fokker Aircraft Factory again changed completely. Once one of the largest manufacturers—by 1935 when Anthony Fokker celebrated his 25th anniversary as an aircraft designer, the Fokker company had sold 1,200 complete aircraft, plus 23 licences to 16 different countries—it no longer ranked among the world's leaders. Nevertheless, together with Aviolanda (founded in 1927 by the Rotter-

PZL-102 *Kos* two-seat sports aircraft (Poland), with 65 h.p. Narkiewicz WN-1 engine.

Saab-32B *Lansen* two-seat all-weather fighter taking off: *Avon RM.6* engine, built by Svenska Flygmotor, with Swedish afterburner.

Saab-35 *Draken* supersonic single-seat fighter, also with *Avon RM.6* and Swedish afterburner.

dam shipbuilder Burgerhout to build Dornier flying boats under licence for the Netherlands Naval Air Arm), Fokker is today responsible for all aircraft manufacture in the Netherlands.

At the present time, the name of Fokker is again connected with the civil market, with the F.27 *Friendship*, short-to-medium-range turboprop transport, which is already in service in Europe and Australia and is being produced under licence by Fairchild in the United States. The *Friendship* will take part in the flying display at the Paris Air Show, where Fokker will also have two stands, one for its aircraft and the other for auxiliary products. Chief exhibit on the latter stand will be the *Fokker-Eckold universal sheet shaping machine*, which is in use in aircraft factories in many parts of the world. The model on show this year is equipped with new shaping tools especially designed to shape narrow-angled extrusions. These include plastic jaws made of special very hard, heat-resisting material which, however, is delicate enough not to damage the work piece.

This same stand will also be showing the new *Fokker pneumatic joggling machine*—electronically controlled—to joggle under pressure. In this machine the vertical flanges of the extrusions are included in the operation, which enables the complete extrusion section to be joggled in one process. A third exhibit will be the *Fokker Bond Tester* (Type II) for non-destructive testing of the strength and physical properties of bonded joints. Correlation curves between Bond Tester readings and shear strength, based on Fokker applications, are available for a number of sheet thicknesses for metal-to-metal bonds on the Redux process.

The H-3 *Kolibrie* ramjet helicopter, designed and built by the Nederlandse Helicopter Industrie, an affiliate of Aviolanda, will be visiting the Paris Air Show for the first time this year. The *Kolibrie* is a short-range, ultra-light two-seat model with two tip-powered rotor blades, for use for agricultural and ambulance duties and other purposes. The airframes are built by Aviolanda, while Fokker produces the rotors, and Kromhout, an Amsterdam engine manufacturer, the NHI-designed ramjets. *Kolibries* are already in service for agricultural purposes in Holland, Britain and Israel. They have also been used for television recordings from the air.

Polska Rzeczpospolita Ludowa - Poland

Poland's aircraft industry will be represented in Paris by the *Motoimport* foreign trade organization, of Warsaw, and is expected to make the first international public showing of a whole series of new designs. At the time of writing no definite information is available on just what items will be exhibited, but it seems likely that they will include the new *M-2 two-seat trainer* built by the state-owned Polskie Zaklady Lotnicze plant. The M-2 is of all-metal construction and is powered by a Czechoslovak 220 h.p. *Praga-Doris B* engine. Alternatively, the airframe is also designed to take the Polish WN-6R engine of roughly 180 h.p. Other types on display will almost certainly be the *PZL-101 agricultural aircraft* (derived from the Russian Yak-12) and the *PZL-102 Kos*, two-seat sports and touring aircraft (65 h.p. WN-1 four-cylinder engine). Finally, it is not out of the question that the strutted high-wing *Kania 2* sports model and glider tug, with 120 h.p. Russian M.11D engine, will also come to Paris.

Regular visitors to the Paris Shows will recognize the *SM-1 helicopter*, which is built in several versions, and the *TS-8 Bies* two-seat trainer, with both of which Poland made its post-war debut in Paris two years ago. In all probability both will again be shown both on the ground and in the air. Polskie Zaklady Lotnicze will, finally, exhibit a wide variety of aircraft equipment (HEA-40 electrical artificial horizon, GM-231 generator, PDM-100 transformer, etc.) and possibly also *aircraft engines* and *gliders* of Polish design and production.

Saab-91D *Safir* four-seat sports aircraft and trainer, with 180 h.p. Lycoming 0-360-A1A engine.

Sverige - Sweden

The Swedish aircraft industry is participating on a bigger scale than ever before in this year's Salon de l'Aéronautique—perhaps because of the interest shown by several foreign air forces in the Saab 35 *Draken* all-weather supersonic jet fighter.

Saab will be showing three different aircraft types, including the current production version of the 35A *Draken*. This aircraft will take part in the flying display, where it will have an opportunity to show off its excellent take-off and landing characteristics. The 35A model is now in full production and will go into service with the Swedish Air Force later this year. The second aircraft in the Saab exhibit will be the 32B night fighter version of the *Lansen* multipurpose transonic jet combat aircraft. This version, which will be seen on the ground only, has a more powerful engine than the attack *Lansen*, namely a Swedish-built Rolls-Royce *Avon Series 200* with a large Swedish-designed afterburner. Various external armament alternatives will also be on display for this aircraft. The Saab 32B, which has also a more advanced fire control system and armament than earlier *Lansen* versions, is in large-scale production and in service with the Swedish Air Force. Finally, Saab will show the 91D model of the *Safir* trainer, which has recently been the object of substantial orders from three air forces—Finnish, Ethiopian and Swedish —and from the Dutch Government's civil flying training school (Rijksluchtvaartschool). The 91D will also take part in the flying display.

On its stand in the exhibition building Saab will display modern electronic fire control equipment for aircraft, as well as the BT9 Toss Bomb Computer and the BT13 Hit Indicator gunnery training device.

Sweden's aircraft engine manufacturers, **Svenska Flygmotor AB**, of Trollhättan, is also participating in the static show. Its most important exhibit will be the RM.6 engine, a Swedish licence-built version of the Rolls-Royce *Avon Series 200*, and the afterburner developed for this engine in conjunction with the Swedish Air Board. In view of the fact that Flygmotor last year disclosed both ramjet and rocket engines of its own design, it is probable that some of these models will also be shown.

The third Swedish exhibitor in Paris will be **Bofors**, who is participating for the first time. This well-known firm of armament manufacturers will show 75-mm air-to-air and 13.5-cm air-to-ground rockets, air-to-air rocket pods, 80-kg flares and a new light anti-tank missile.

Tupolev Tu-104 jet airliners at Moscow's Vnukovo Airport.

Although the new Soviet turbine-powered aircraft will handle the major part of Aeroflot's future domestic and international traffic, increasing use is also expected to be made of small transports and feeder aircraft, including the Yak-12A (below), a development of the well-known Yak-12M, and the twin-engine Antonov An-14 *Psholka* STOL model (above). The Yak-12A has a top speed of 116 knots, the An-14 of 124 knots; range of the former with pilot and three passengers is roughly 540 nautical miles, of the latter with 1,320 lb. payload is around 325 nautical miles.

Sidelights from Moscow

The Soviet Union's announcement that it plans to send one or two jet airliners to the Paris Air Show has once more drawn attention to the Russian air transport system and to the aircraft industry behind it. This would therefore appear to be an ideal moment to publish brief reports on the latest developments in Soviet aviation; it is hoped that this can be made a regular feature.

• Aeroflot's scheduled route network is to be extended by 25,000 miles under the USSR's new seven-year plan (1959 to 1965).

• To the two scheduled helicopter services already in operation—Simferopol-Yalta (Crimea) and Sotchi-Adler-Aigba (Caucasian coast of the Black Sea)—by 10-passenger Mi-4 rotorcraft, forty new services, covering stage lengths of 10 to 260 miles, will be added during the current year.

• Under Aeroflot's summer timetable, the Moscow-Peking route will be operated three times a week by Tu-104, the Moscow–Amsterdam service twice a week. A new Tu-104 service, from Moscow to Pyongyang, has been opened. Since April 15th, twin-jet Tu-104Bs for 100 passengers have been flying twice a day between Moscow and Leningrad (flying time 55 minutes), while turboprop Il-18 *Moskvas* have been used on the Moscow–Alma Ata route. Single fare on the roughly 400-mile Moscow–Leningrad stage is 130 roubles (allegedly less than the regular rail fare).

• On March 12th, 1959 Fedor Beluchkin attained a record altitude of 6,702 m in a production Mi-1 piston-engine helicopter.

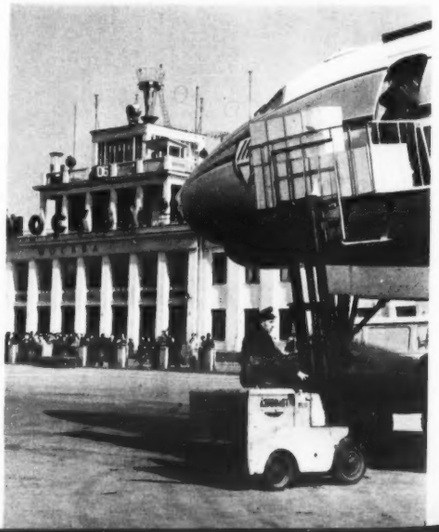
• Increasing use is being made for pilot training in the USSR of the Yak-18A piston-engine trainer, with 260 h. p. AI-14R radial engine. This is an advanced model of the Yak-18 (160 h. p. engine) which has been in service for years. The Yak-18A, designed also for aerobatic training, has a max. speed of 142 knots, a service ceiling of roughly 16,400 ft. and a sea level rate of climb of 1,060 f. p. m.; gross weight is 2,890 lb. Another model in wide-spread use is the single-seat Yak-18P, which has a lower gross weight (2,315 lb). and a top speed of around 162 knots.

• Development of the four-turboprop Antonov An-16 for 130 passengers—a successor to the An-10 *Ukraina*—appears to be advancing according to programme. Route proving of the 100-passenger An-10A is reported to have been completed.

• The Soviet supersonic bomber with delta wing (NATO designation *Bounder*), mentioned in the Western press for some time past, is now reportedly in extensive squadron service. Contrary to earlier reports, it has four—not six—large jet engines, installed in separate pods beneath the wings and at the wing tips. Top speed is apparently lower than at first assumed and does not reach the figure of Mach 2 ascribed to its American counterpart, the Convair B-58 *Hustler*.

Ilyushin Il-18 turboprop transport at Krasnodarsk during a route proving flight.

Loading a Tu-104 at Moscow Airport.



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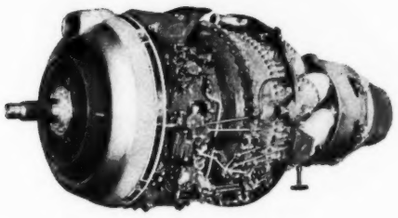
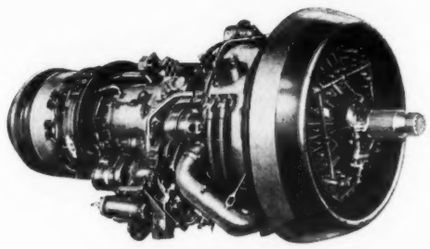


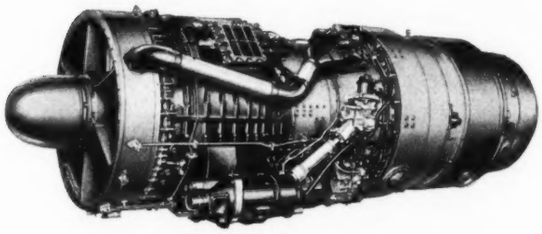
DART PROP-JET

In service or under development at powers ranging from 1,540 e.h.p. to 3,200 h.p. The Dart is the most proven prop-jet in the world and has flown over 7,000,000 hours in scheduled airline service. It has an unexcelled record of reliability and is currently operating at overhaul lives of up to 2,300 hours.

TYNE PROP-JET

The Tyne is an advanced twin spool high compression engine due to enter service in 1960 at ratings of 4,985, 5,545 and 5,730 e.h.p. It has been designed to give low specific fuel consumption and is backed by the unique experience gained by Rolls-Royce in the operation of gas turbine engines in scheduled airline service.



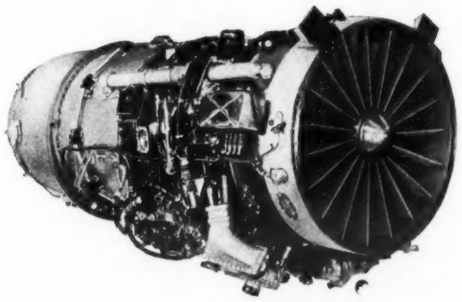


AVON TURBO JET

The Civil Avon has been developed to give low fuel consumption and long life between overhauls. The British Air Registration Board authorised its entry into service at an overhaul life of 1,000 hours.

CONWAY BY-PASS TURBO JET

The Civil Conway has the advantages of low first cost and operating costs, low weight, less noise and low specific fuel consumption. Initial Civil Conways have a guaranteed minimum thrust of 16,500 lb. and engines of 17,500 lb. guaranteed minimum thrust, will be available.



RB. 141 BY-PASS TURBO JET

The RB. 141 has been designed from the outset specifically for civil airline applications with the object of producing the best possible commercial engine for future jet transport aircraft. Engines with take-off thrusts of 13,600 lb. and 14,300 lb. will be available early in 1962.

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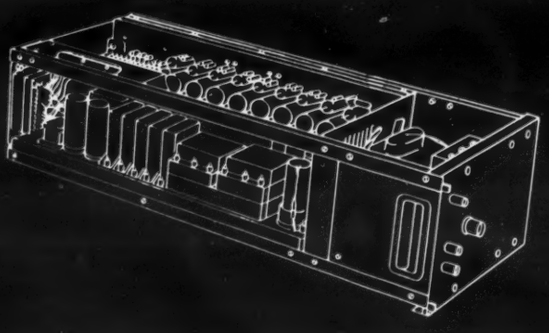
Following the I.C.A.O. recommendation of civil secondary radar for air traffic control purposes, B.O.A.C. has placed an order for Cossor Secondary Radar Transponders for its fleet of Boeing 707s. In the U.S.A. the carrying of secondary radar transponders is already mandatory for civil jet airliners.

These steps followed extensive evaluation of the system in the U.K. and the U.S.A. for which Cossor supplied ground equipment as well as airborne transponders.

The use of secondary radar permits more reliable observation of aircraft, particularly at great heights or long ranges; it also permits the transmission without intervention of the pilot, of information concerning the aircraft, such as its height, route or identity.

The Cossor SSR.1951 transponder is designed in accordance with the recommendations of I.C.A.O. and the engineering requirements of ARINC 532B.



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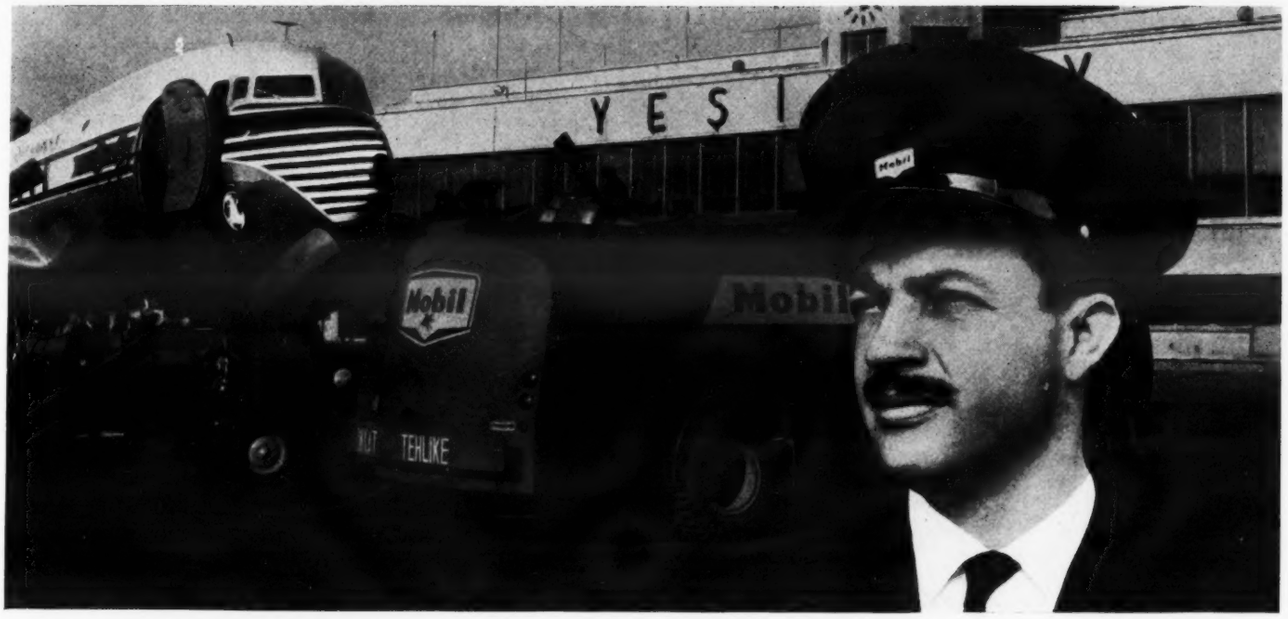

Mobil men in Turkey

Ankara and Istanbul are key centers in the progress and growth of world commercial aviation. They serve not only the continuous flow of international business and pleasure travellers, but generate an ever-increasing volume of local business and vacation air traffic. Airlines using either of these international airports find themselves in the capable hands of seasoned Mobil men.

A twelve-year Mobil veteran, Mr. Orhan Ceylan is refueling supervisor at Ankara. Formerly with the Turkish Air Force, Mr. Ceylan was sent to the U.S.A. where he added to his experience with intensive training in U.S. aircraft maintenance techniques. Previously an assistant air field supervisor at Yesilkoy airport, Mr. Ceylan has been supervisor at Ankara for the past six years.

At Istanbul, aircraft crews are met by tri-lingual Mr. Erdogan Yener, a former Turkish Navy reserve officer. Mr. Yener, an Ankara College mathematics graduate, has spent six years with the Company and served at the Ankara relay depot prior to the Yesilkoy assignment as refueling supervisor.

Both these men are typical of the tried, trusted, seasoned personnel employed by Mobil companies throughout the world. All their training has led up to their vital job — the safe refueling of commercial airliners with quality Mobil products.

Mobil is proud of its Airport Supervisors.

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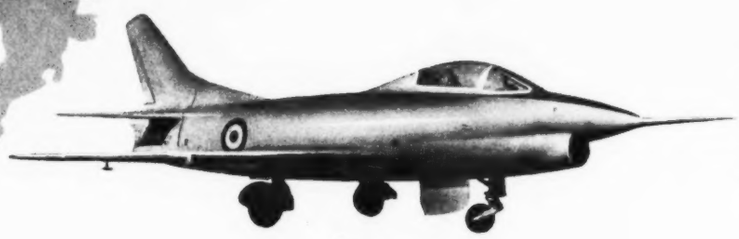

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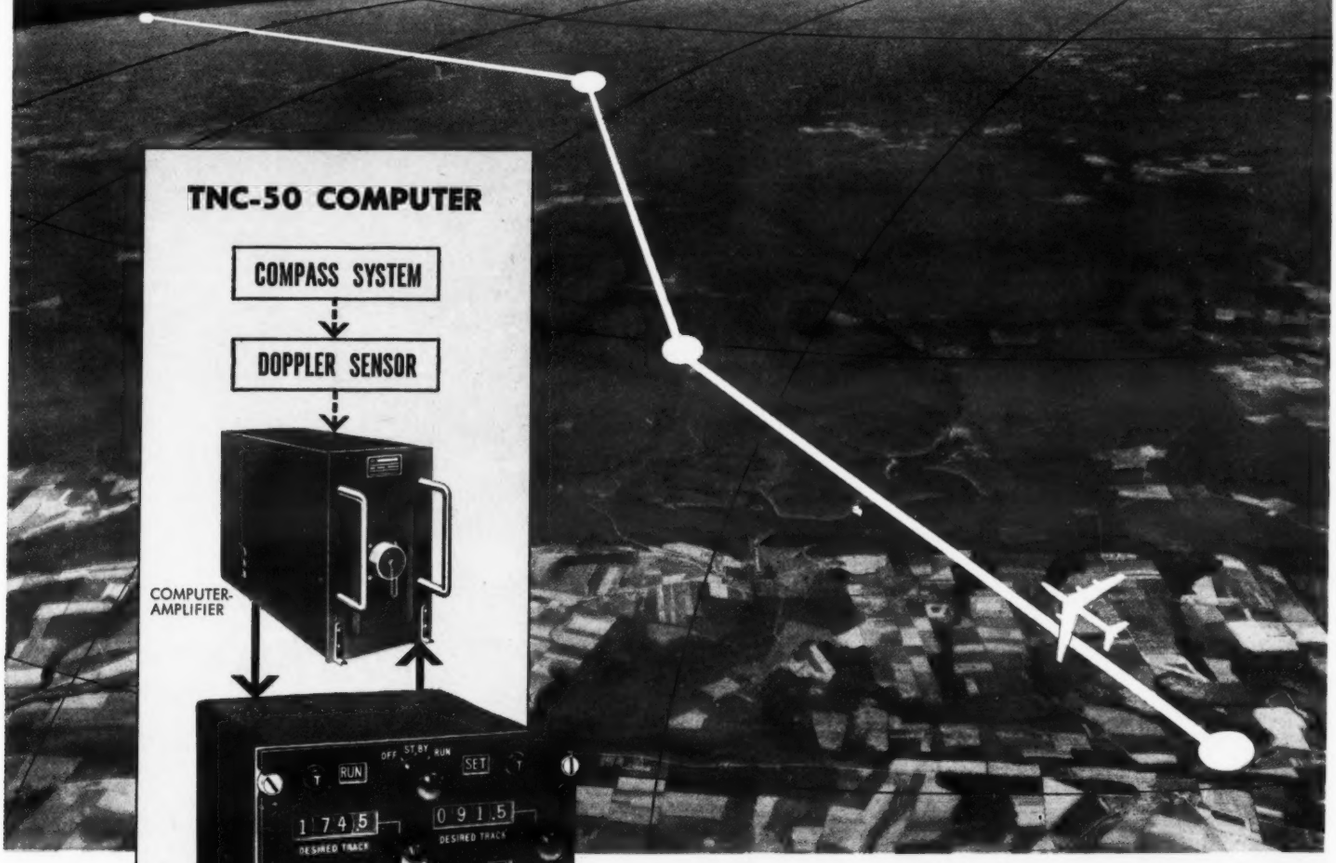
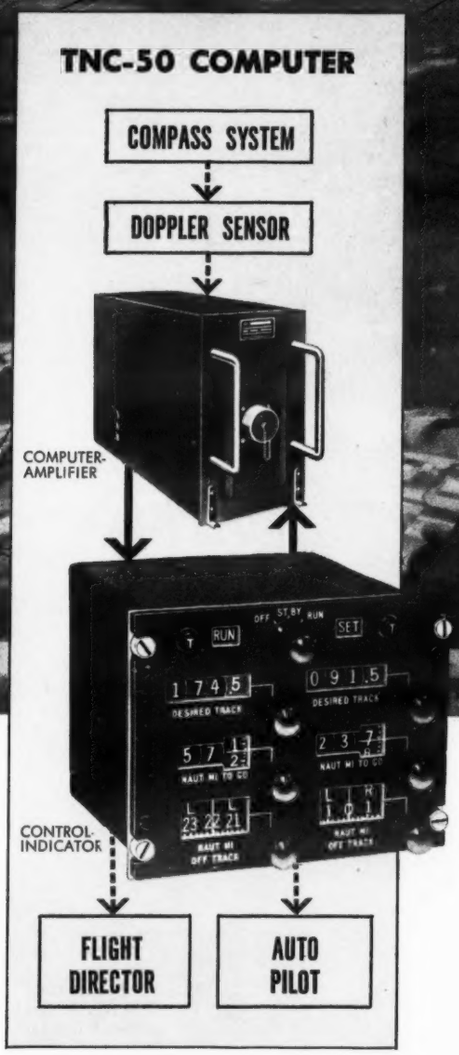
GPL track navigation computer TNC-50

continuous readings of distance to go and distance off track...





TNC-50, GPL's new Track Navigation Computer, provides direct outputs of distance to destination and distance left or right of track. Designed to function with ARINC and other Doppler sensors, and any modern aircraft heading reference, the TNC-50 provides additional outputs for flight directors, autopilots, and attachments.

REALISTIC APPROACH: Utilizing the concept that a flight plan is composed of one or more segments, the TNC-50 provides continuous progress displays of ***distance*** and ***deviation*** along these segments, thereby eliminating complex latitude-longitude instrumentation.

THE RESULT: a compact, accurate computer providing continuous visual and command information to the pilot, and steering information to the automatic flight controls. Write for further data on the TNC-50 and GPL's new ARINC Doppler sensor, RADAN® 500.

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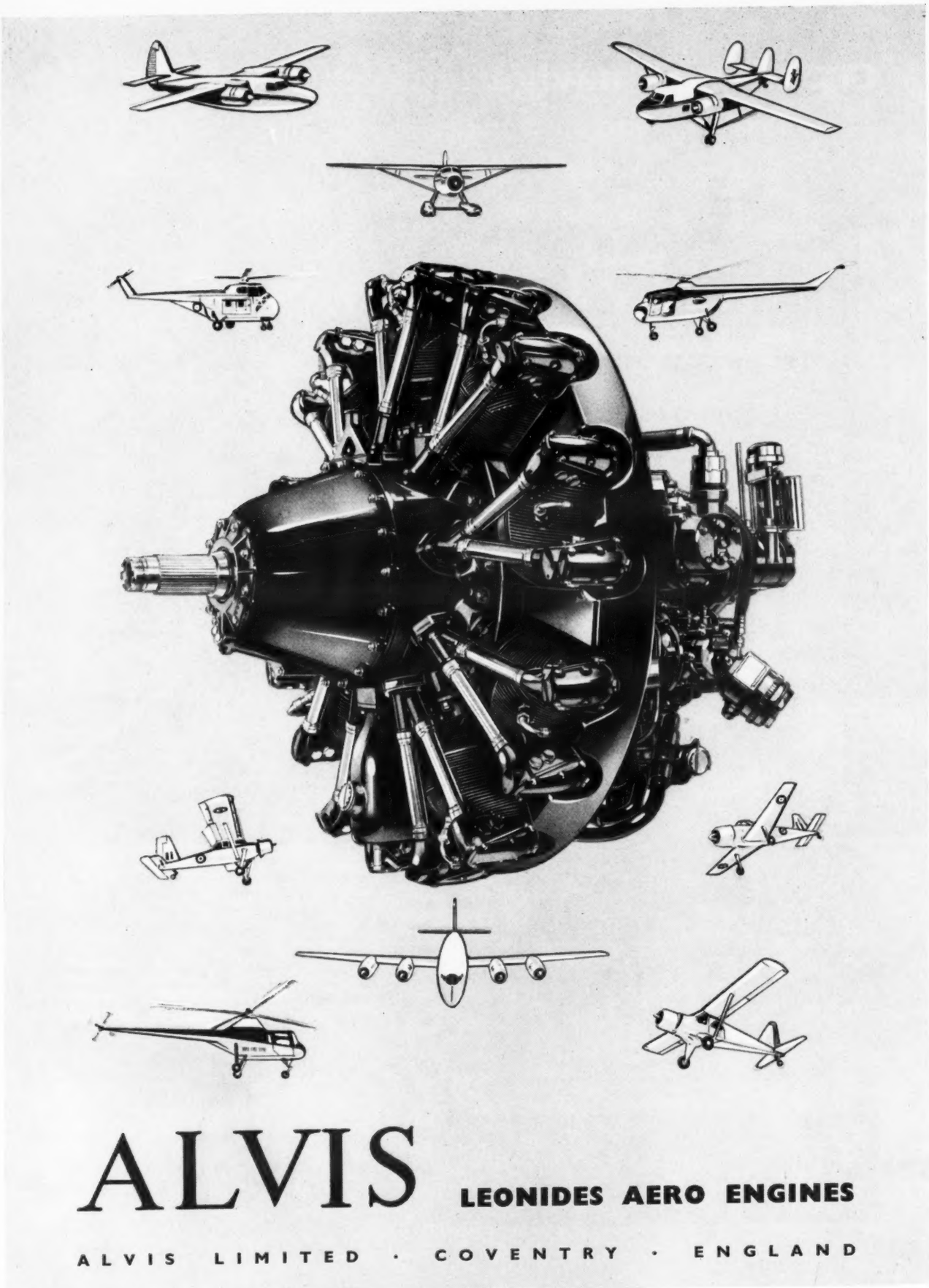
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Preparing Airline Timetables in the Jet Age

By Hans Scharlach, Head of the Flight Planning and Fares Section, Deutsche Lufthansa, Cologne.

The employment of jet aircraft—initially on intercontinental and later on the major continental routes—which began with the introduction of jet services between the Old and New Worlds in the late autumn of 1958 and will steadily intensify until the summer of 1960 when a large number of airlines will have received their new equipment, also brings a series of new problems for the schedule planners. Flying time and hence round trip time will be cut by almost half, and the whole timetable structure on many of the world's main air arteries must inevitably be entirely reorganized, on the one hand to ensure optimum utilization of fleet capacities and on the other with the object of saving time for passengers, mail and freight. In cases where in the past the round trip for an aircraft has been two, three or more days, as for example on the long-range routes from Europe to North America, South America, the Far East and Australia, all operating and maintenance plans will in future be based on a much more rapid turnaround of the aircraft fleet.

It is not only the shrinking of all hitherto normal distance and time notions, however, which will leave its mark on future timetables. Another factor, namely that on many routes running parallel to the sun's course the jets will follow much more closely on the sun's heels, will complicate to an unprecedented extent the planning of timetables to be favourable from both the sales and the operational points of view.

The following examples give the mean journey times from and to Europe, with special reference to the Central European area delimited roughly by a line joining London-Copenhagen-Vienna-Geneva-Paris-London.

The new factor which emerges from these figures is that for certain routes—including those with the heaviest traffic—the night can no longer be used, in one direction at any rate, even on very long distances. The night is simply " too long " to enable both favourable departure and favourable arrival times to be arranged for passengers. When a flight from Central Europe to New York takes only three " local hours ", it will no longer be possible to leave Europe in the late evening hours (22:00 to 24:00 hrs), as is frequently done today, as passengers would then arrive in New York at a most inconvenient night hour (02:00 to 04:00 hrs). And attractive as it might be to arrive in Manhattan between 06:00 and 08:00 hrs, passengers cannot normally be expected to leave Central Europe between 02:00 and 04:00 hrs. It follows that flights *to* North America will generally be made with the sun by daylight, though night flights will continue to be the rule in the reverse direction.

Before going into details of the effects of jet aircraft on North Atlantic timetables, let us look into the scheduling problems which will arise on routes between Europe and other parts of the world: to South America it will be possible to plan jet services both during the night hours and in daylight. On this route—e.g. to Rio de Janeiro—the night is just long enough to enable an aircraft to depart from Europe shortly before midnight and arrive above the Sugar Loaf the following morning and in Buenos Aires around noon. In the north-south direction these distances are also suitable for pure daytime services, provided the latter are not required to connect with too many local services on either side of the Atlantic. From South America to Europe, on the other hand, flights will probably continue to be made by night, as this is the only way that adequate connecting services can be provided in the two continents.

For traffic between Europe and Southeast Asia/Australia, at any rate if the " conservative " India route is envisaged, Europe is in as similar a geographical situation as North America is in relation to Europe. Flights take place against the sun, so that the actual journey time is increased by the difference in local times, e.g. six hours for a service between Central Europe and Bangkok, and nine hours for a flight to the east coast of Australia. In " local hours " a flight to Sydney takes roughly twice as long as in the opposite direction. For services to destinations east of Karachi/Bombay the timetable will probably include the night hours, particularly if they are to connect with flights arriving in Europe from North America in the morning hours. Departures for the Far East and Australia will then be made roughly in the middle of the day. The return trip to Europe, made with the sun, is an equal number of " local hours " shorter. A one-day flight from Sydney to Europe (e.g. leaving Sydney at 07:00 hrs) then begins to enter the realm of the possible, even with several intermediate landings. From Bangkok it will even be possible to depart during the local midday hours and still reach Central Europe the same evening. The same applies for a journey from Tokyo to Europe by the Arctic route. Making allowance for the international date line, flying time would be barely nine hours in " local hours ". In the opposite direction the flight would take roughly 26 hours. These

Actual and " sun-corrected " travel times for jet services

Route	Intermediate call	Actual journey time (flying hours)	Minus " local hours " since with sun	Plus " local hours " since against sun	Corrected journey time in " local hours "
Europe-New York	—	8	5	—	3
New York-Europe	—	7	—	5	12
Europe-Chicago [a]	1	10 1/2	6	—	4 1/2
Chicago-Europe [a]	1	9 1/2	—	6	15 1/2
Europe-Miami [a]	1	11 1/4	6	—	5 1/4
Miami-Europe [a]	1	10	—	6	16
Europe-Mexico [a]	1	13 1/2	7	—	6 1/2
Mexico-Europe [a]	1	12	—	7	19
Europe-Los Angeles [a]	1	14	8	—	6
Los Angeles-Europe [a]	1	12 1/2	—	8	20 1/2
Europe-Rio [b]	1	13 1/4	4	—	9 1/4
Rio-Europe [b]	1	12 3/4	—	4	16 3/4
Europe-Buenos Aires [c]	2	16 1/2	4	—	12 1/2
Buenos Aires-Europe [c]	2	16	—	4	20
Europe-Karachi [d]	1	9	—	4	13
Karachi-Europe [d]	1	9 3/4	4	—	5 3/4
Europe-Bangkok [e]	2	14 1/4	—	6	20 1/4
Bangkok-Europe [e]	2	15 1/2	6	—	9 1/2
Europe-Sydney [f]	4	23	—	9	32
Sydney-Europe [f]	4	25	9	—	16
Europe-Tokyo [g]	1	18	—	8	26
Tokyo-Europe [g]	1	16 1/2	8	—	8 1/2
Europe-Johannesburg [h]	2	14 1/2	—	1	15 1/2
Johannesburg-Europe [h]	2	15 3/4	1	—	14 3/4

Intermediaire calls

[a] e.g. at New York
[b] e.g. at Dakar
[c] e.g. at Dakar and Rio de Janeiro
[d] e.g. at Cairo or Beirut
[e] e.g. at Cairo or Bairut and at Karachi or Bombay
[f] e.g. at Cairo or Beirut and Karachi or at Bombay and Bangkok and Jakarta
[g] e.g. at Anchorage (Polar rout.)
[h] e.g. at Rome or Cairo and at Nairobi

The times given are mean values for the summer period (making allowance for " local summer times ") which must be increased or decreased depending on the location of the European city concerned.

examples show clearly how closely the jet aircraft follow the sun on many world routes.

When it comes to South Africa, the sun's travel makes little difference on services from Europe. As most of the Central European and African centres lie on roughly similar longitudes, local differences in time will be slight. On a flight to South Africa the actual journey time is increased by only one " local hour ", whereas it is reduced by the same amount in the opposite direction. As this route follows roughly the same longitude throughout, daytime flights in both directions will be quite feasible, particularly as there is at present little call for connecting services to and from other parts of the world.

*

For Europeans the effects of the introduction of jet aircraft outlined above will be felt chiefly in traffic with North America, on trips to and from New York. Here the timetables in the east-west direction will suffer the greatest changes. Whereas of the 309 weekly trans-Atlantic flights in August 1958, only 17, or less than 6 percent, were made during the day, and 292 during the night hours, the near future will in all probability see a far-reaching change in this situation. Most of the jet aircraft (at any rate those belonging to the European airlines) will probably leave their central European airports between 12:00 and 17:00 hrs and arrive at Idlewild three " local hours " later—in winter very often only two " local hours " later. Companies which run only one daily service will doubtless prefer a departure in the late afternoon, as this is more favourable for mail and freight, while airlines with several flights a day between Europe and the United States can stagger departures in both directions over the day. One determining factor in the planning of schedules—in addition to the convenience of passengers and other loads—will be the fact that jet aircraft, which fly at speeds of 500 to 550 m.p.h. can make the round trip Europe-New York-Europe or New York-Europe-New York within 24 hours, with a stop of roughly four to five hours at each end, thus providing the essentials for economic operation. Aircraft leaving Central Europe by about 17:00 hrs and thus arriving in New York around 20:00 can begin the return flight from New York at around midnight, the normal departure hour for steamers, and get back to Europe around noon the following day. For aircraft leaving this side in the morning or towards noon, the return time from the other side will be correspondingly earlier. Whatever times are chosen, the 24-hour cycle will be maintained.

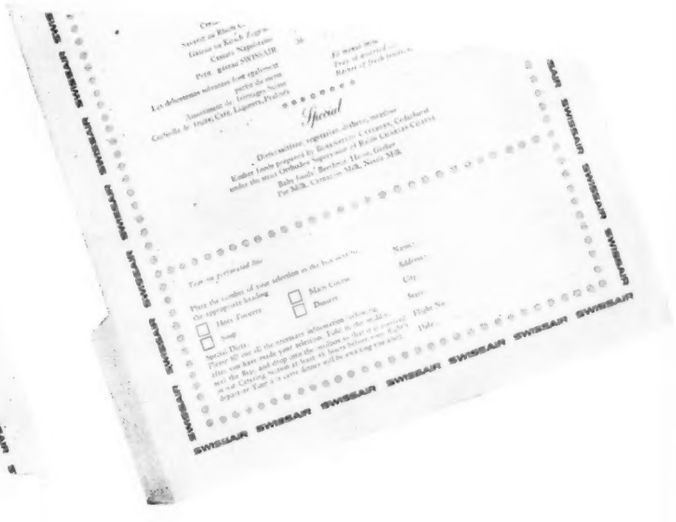
The European businessman who takes the 17:00-hr aircraft can therefore make use of practically the full working day in Europe and still go to bed that evening in New York. Even if his destination is in the Middle West or on the Pacific coast, he will not need to begin his journey from Central Europe before the afternoon, but will still be in Chicago, Los Angeles, San Francisco, Seattle or Mexico City before local midnight. In each case he will catch the evening aircraft from New York to these centres. During the flight westwards across the American continent the traveller again benefits from the difference in local time, which cuts journey time for a non-stop flight from New York to Los Angeles from an actual four and a half hours to one and a half " local hours ".

In the North America-Europe direction the majority of flights, even by jet aircraft, will initially be made during the night. A switch to daytime operation cannot be expected until cruising speed rises to roughly Mach 2. But in this direction, too, the traveller from America will save considerable time, thanks to either a later departure or an earlier arrival. Because of the prevailing west winds average flying time will be roughly an hour shorter than in the east-west direction.

The remodelling of flight timetables will also have a marked effect on the route and timetable structure of the feeder services, particularly on the European side. The advisability of moving forward departure times to the west to an earlier hour greatly reduces the time available for feeder services, if departures at very early morning hours, inconvenient to the passenger, are to be avoided. Here much will depend on whether the North Atlantic feeder services also have tasks to perform within the continent (e.g., to carry passengers from the peripheral areas to the centre of Europe or to the western capitals). Compromise solutions will not be entirely avoidable, and it may even be necessary to reorganize the whole system. The promising inner-European network, which also reaches out to North Africa and the Middle East, requires and deserves full consideration when timetables are being planned. It should not be neglected, or have its potential expansion restricted, in favour of the often contradictory requirements of connecting services for intercontinental routes. Moreover, as the time is approaching when suitable jet aircraft will be available to replace piston-engine transports on medium-length stages, it will probably be only during a relatively short transition period that difficulties will be experienced in " intermeshing " intercontinental and continental timetables.

Gourmets in the Air

To cater for individual tastes, Swissair is offering travellers on its de luxe class services Zurich-New York the possibility of choosing their own menu for the in-flight dinner. On booking their flights, passengers are presented with an attractively designed menu listing a choice of six hors-d'œuvres, three soups, ten main dishes and six desserts. The selected dishes may be entered on the accompanying order card, and posted to Swissair's service department, prior to the flight.



The First Air France Caravelle Service

By Georges Février, Interavia, Paris

" Yésilkoy control—Romeo Bravo, you are clear to take off."

8,200 r.p.m. The muffled drone of the two jet engines hardly seems to have changed. We start rolling. I press my stopwatch. The ASI needle commences to move, slowly at first then more quickly, 60 knots, 80 knots, 90, 100, 110, 115. We are airborne—26 seconds.

" Undercarriage ?—Up. Flaps ?—Up."

On the altimeter the large needle beats all records, we are climbing at 3,000 ft. per minute.

The sun, already low, gilds the waters of the Bosphorus, and St. Sophia with its dome and minarets looks no more than a pin cushion. Farewell, Istanbul.

•

I have the great privilege of being with Louis Lesieux, Managing Director of Air France, in the cockpit of " Lorraine ", the French company's first production *Caravelle* which is flying the first service Istanbul-Athens-Rome-Paris. Once again I marvel at the apparent ease of handling, the silence broken only by radio calls, and the absence of vibration.

In the cabin is the usual complement of VIPs, Ministers, Members of Parliament, officials and journalists. Pleasantries pass over the champagne. Max Hymans chats with the former Prime Minister Paul Reynard, and Paul Moroni, Secretary General of Civil Aviation, discusses Europair with Jean Poirier, the technical adviser to the Minister of Transport. We have already forgotten that we are flying at 500 m.p.h., that we are at 26,000 ft. and that the temperature outside is 46 below zero.

The armchairs are excellent, we might be in a pullman, but a pullman which has not yet left the station, a pullman with neither the bumps or noises of a train. Having flown in all the modern aircraft in service, I believe I can say without being accused of chauvinism that the *Caravelle* is absolutely without compare.

But already, air brakes out, we descend towards the aerodrome. There is Piraeus, there the Acropolis...and we touch down on the runway of Athens: 1 hour 11 minutes after take-off.

*

Paris-Rome in 1 hour 55, Rome-Istanbul in 2 hours 20, Istanbul-Athens in 1 hour 11. The air journey proper takes no longer. What still takes time—and this was a special flight—are the Customs and Police formalities, and the transport to the airport disembarkation points. The delays imposed by the control towers are also lengthy. Not all the controls understand as yet that it is not possible for a jet aircraft to start its engines if the take-off clearance is not given immediately, and that, even more than with conventional aircraft, it must have priority on landing over aircraft taking off. To appreciate this one should watch the flowmeters as the hundreds of pounds of kerosene add up at a dizzy speed.

No, the air journey takes no more. It only took us some 9 hours in five and a half days absence. Five and a half days during which we visited St. Peter's in Rome, wandered round the Forum, strolled on the Acropolis, consulted the Pythian oracle and dreamt of the struggles of athletes in the small forgotten stadium of Delphos. Five and a half days in which we admired the wonderful porcelains of Topkapi, rowed on the Golden Horn and visited the Blue Mosque and the Bazaar. What more can I say, the World, conquered by speed, becomes smaller and smaller.

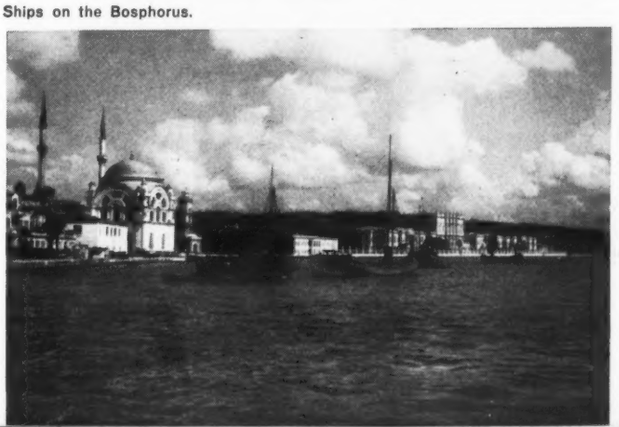
Leaving Istanbul.

Paul Moroni, France's Secretary General for Civil Aviation (outside left) and former Prime Minister Paul Reynaud waiting to board the *Caravelle*.

In the *Caravelle's* cockpit ; Captain Lionel Casse *(left)* and Flight Engineer Jacques Vergine.

Louis Lesieux, Managing Director of Air France (standing), with Jean Poirier, technical adviser to the Ministry of Transport.

Ships on the Bosphorus.



Managing Director Louis Lesieux looks on benevolently as Air France Press Chief F. dela Brosse and Figaro's Georges Ravon discuss their impressions.

Captain André Lesieur at the controls.

Once again I am in my special seat, behind the Captain. It is night, a blue darkness studded with stars, the sky is clear at 35,000 ft., but the ground is invisible. No matter—all Europe speaks to us. In the cockpit, lit only by the orange glow from the instrument panels, the voices of Genoa, Turin, Geneva and Paris are heard.

" Romeo Bravo, you may contact Orly."

Cointrin wishes us goodnight—the journey continues.

" Orly control. This is Romeo Bravo. Estimate our arrival at 42. Commencing letdown at 35."

" Understood. You are clear to descend. Call again at 12,000."

Power reduced—5,400 r.p.m.—we descend.

" Romeo Bravo—go over to approach."

The last check list—Undercarriage ? Down and locked. Air brakes ? Closed. The green lights light up and go out. Flaps ? 20 degrees.

A last question to Paris Approach. The wind ? Eight knots at 040°.

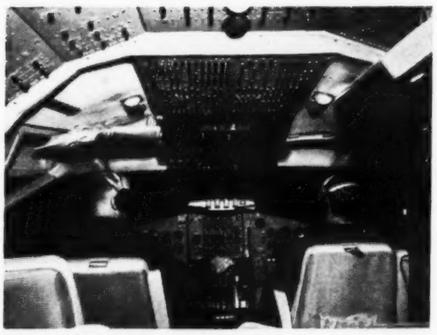
All is ready. The runway lies ahead, brilliant in the darkness. The yellow cross, the red bar, the green. The lights grow larger and larger, the wheels touch the ground.

We are not on time—one minute early !

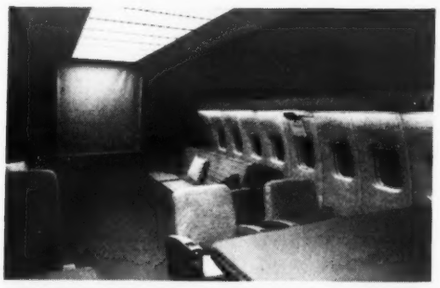
N.B. The author wishes to renew his thanks to his friends the Air France Captains Lionel Casse and André Lesieur for allowing him to ride in the " driver's seat ".

Boeing VC-137A: The U.S. Government's VIP Transport

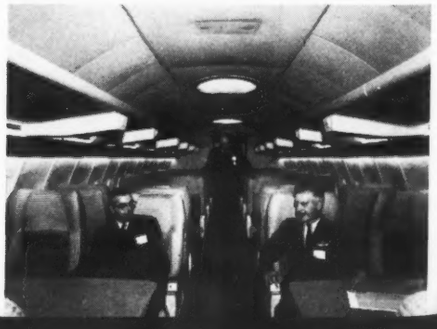
The end of April 1959 saw delivery to the USAF's Military Air Transport Service of the first of three Boeing VC-137A jet aircraft which will be used to transport Government and Defense Department VIPs. The Government aircraft, like the commercial Boeing 707-120, is powered by Pratt & Whitney JT3C-6 jets, and has a completely new interior layout: flight deck for five crew; the forward area contains telecommunications equipment, the galley and a compartment with eight passenger seats; the centre section has a " salon " layout and is equipped with conference tables, an intercomphone line, a special container for charts and a projection screen; the aft cabin has double reclinable passenger seats for a total of 28 passengers, and also galley units, closets, stowage space, etc. Home station of the Government fleet is Andrews AFB, near Washington, D.C.



The VC-137A's flight deck.



The centre section (above) is laid out as a " salon " and conference room ; the aft cabin is fitted with normal first-class seats.



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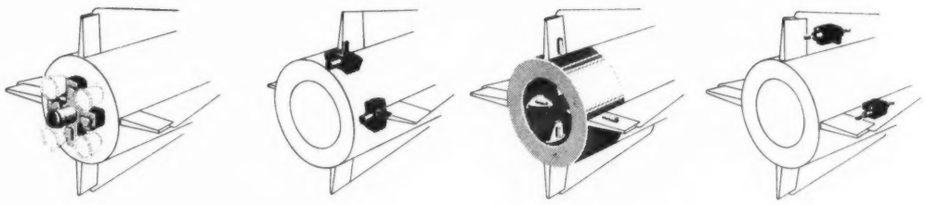

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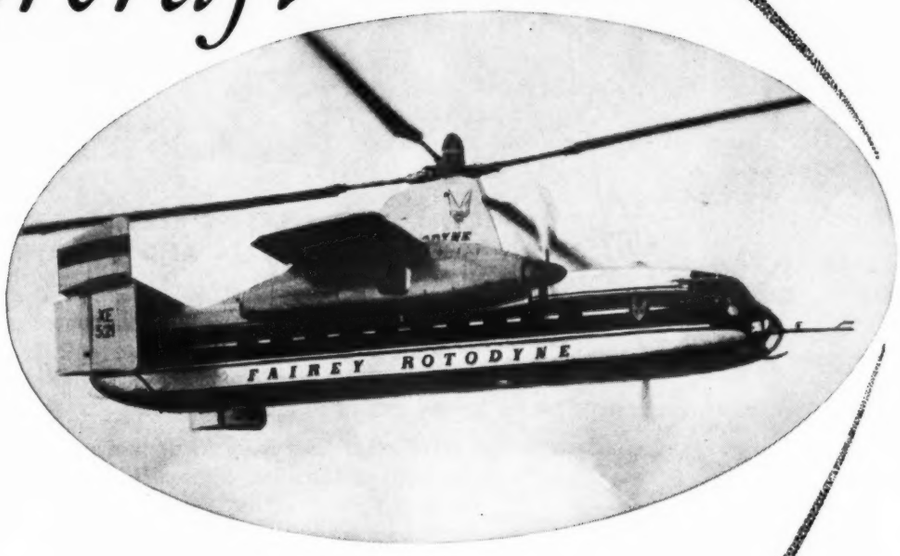

ROTODYNE sets new world record at 191 m.p.h.

Fairey's Rotodyne vertical take-off airliner has established itself as the fastest rotorcraft in the world. On 5th January, 1959, it flew round a 62 mile closed-circuit record course at an officially observed average speed of 191 m.p.h. for a new world convertiplane speed record—at *cruising* power and *operational* weight.

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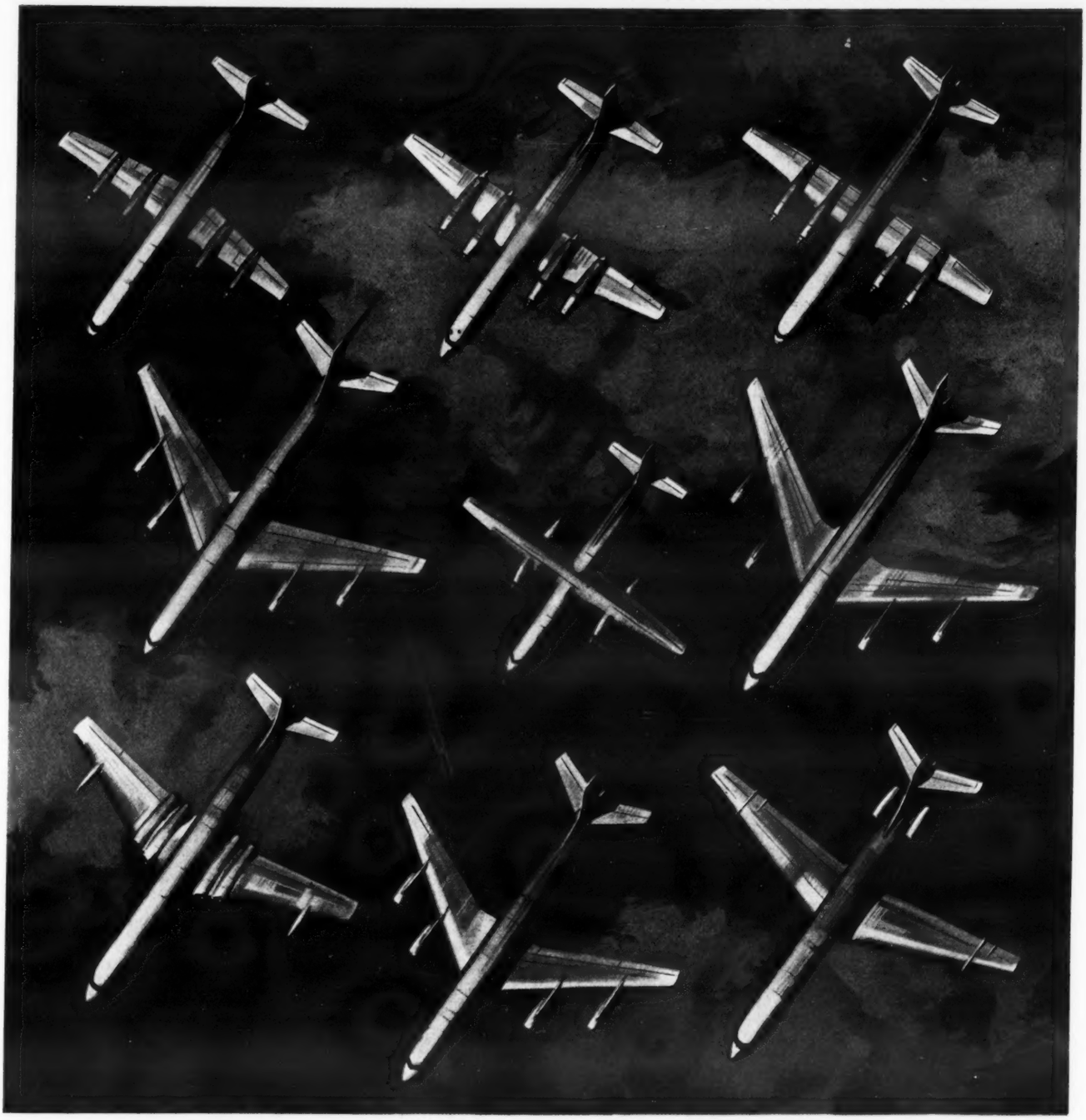
TOP FROM LEFT: LOCKHEED ELECTRA, BRISTOL BRITANNIA, VICKERS-ARMSTRONG VANGUARD. MIDDLE: BOEING 707, FOKKER/FAIRCHILD FRIENDSHIP, CONVAIR 880. BOTTOM: DE HAVILLAND COMET, DOUGLAS DC-8, SUD AVIATION CARAVELLE.



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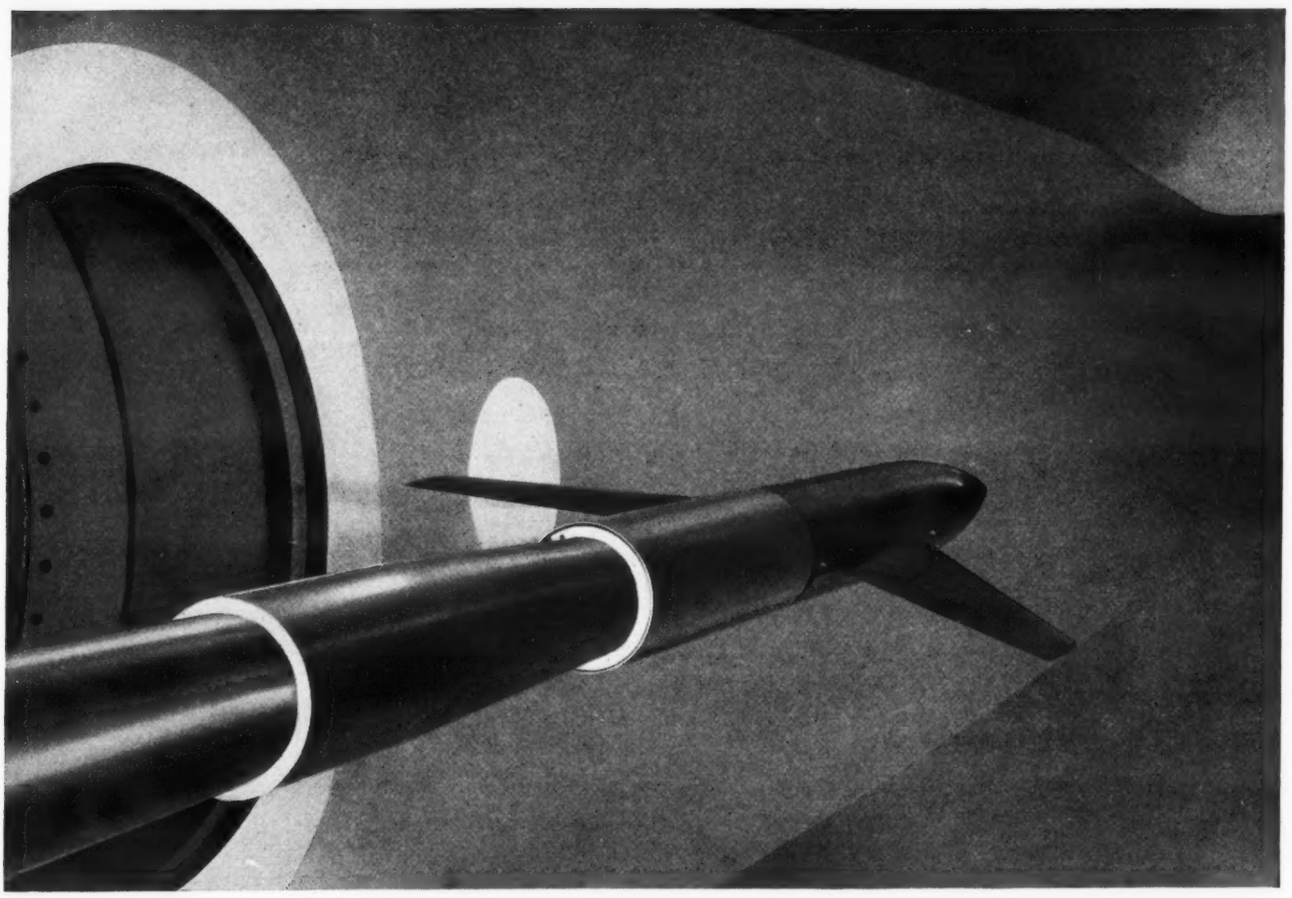

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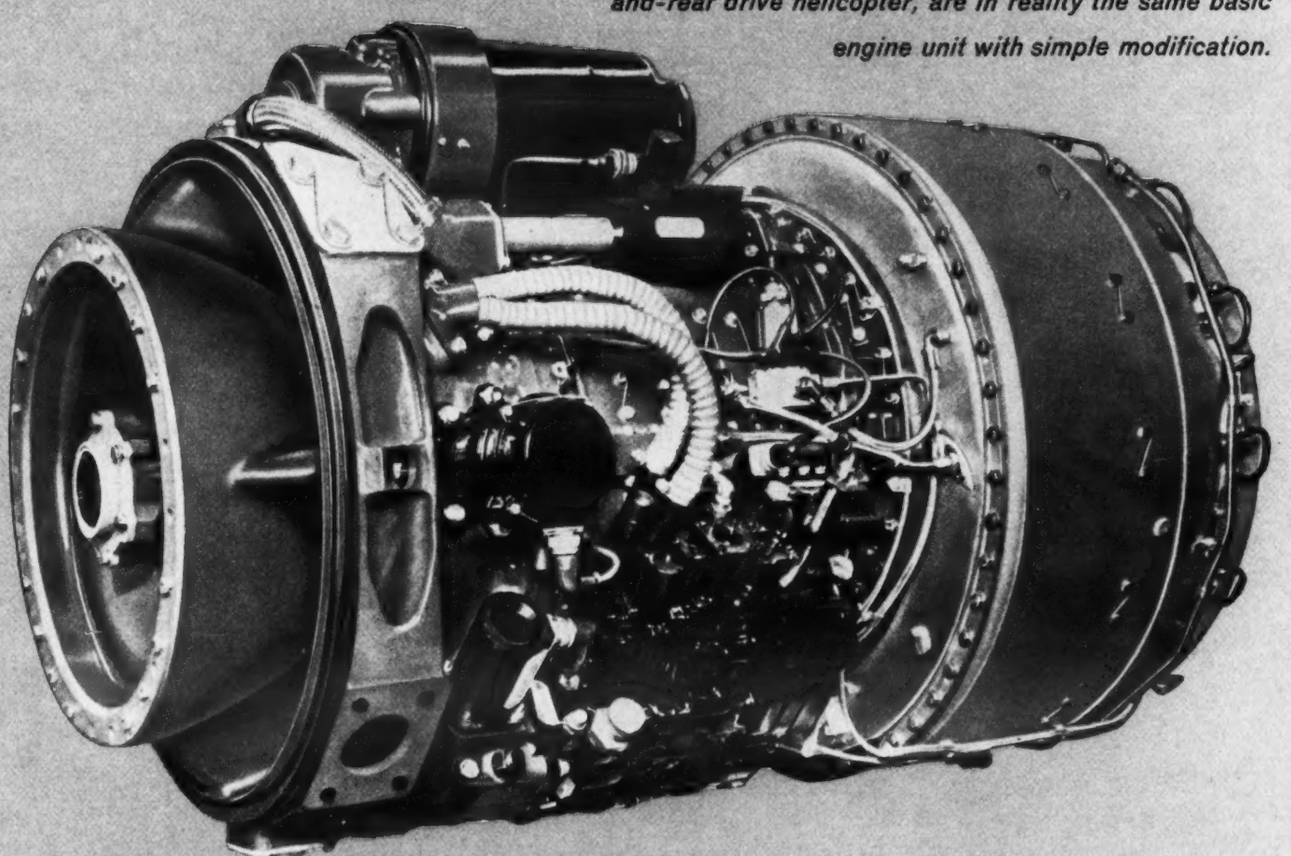

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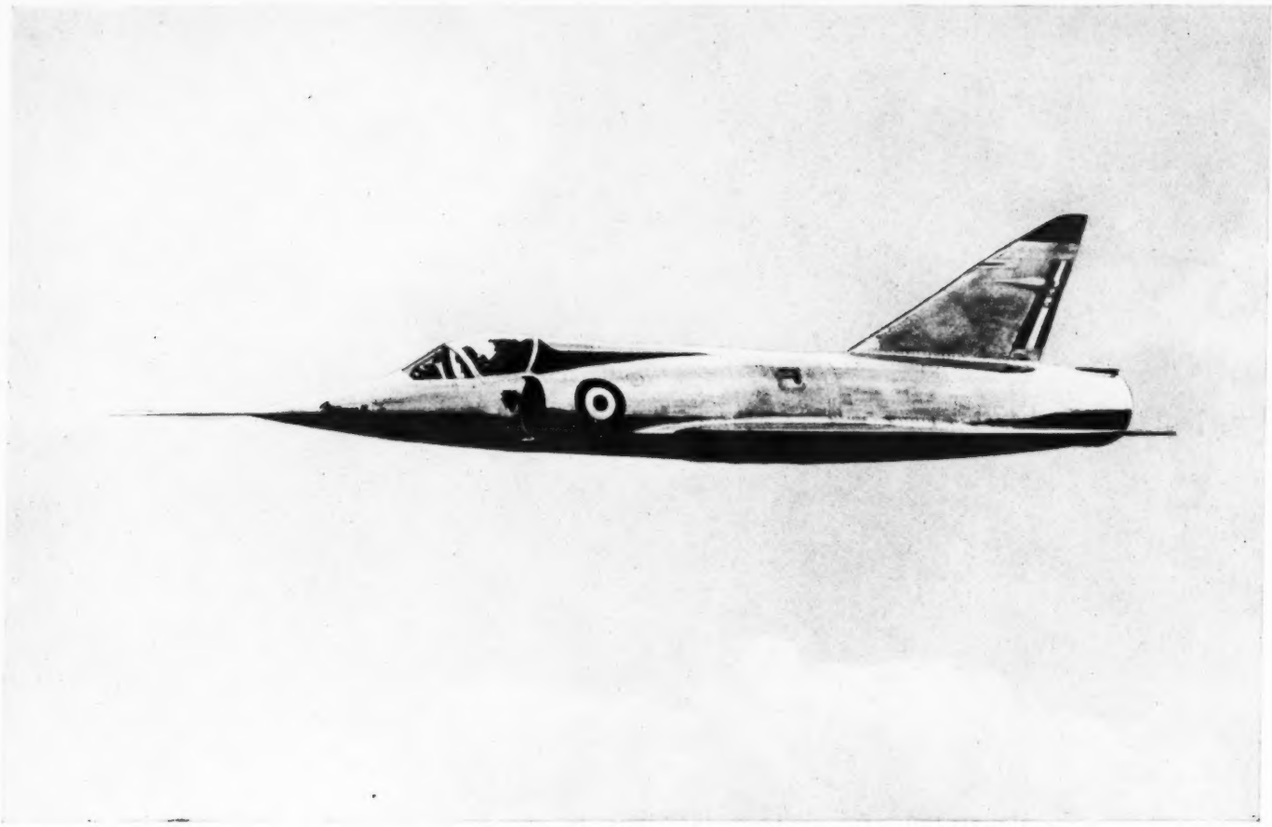

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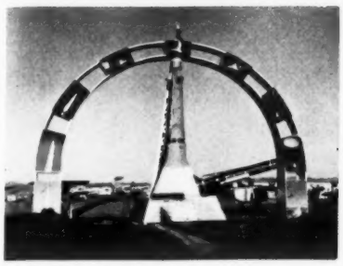


World Congress of Flight

A Picture Report from Las Vegas, Nevada

Information and pictures from Norman Lynn, Interavia's West Coast Correspondent

World Congress of Flight... such was the ambitious title given to the Southern Nevada "super colossal" spectacle, consisting of a mixture of lectures, after-dinner speeches, models and mockups, and (impressive) flight displays, held at Las Vegas and environs during the week of April 13th to 19th, 1959*. The Congress was sponsored by the influential *Air Force Association* (the association of former USAF members) backed by half a dozen other organizations, namely the Air Transport Association of America, the Electronic Industries Association, the Flight Safety Foundation, the National Aeronautics Association, the National Business Aircraft Association and the Space Education Foundation.

Needless to say the *U.S. Air Force* was also present, in impressive strength, as the Congress also coincided with the celebration of NATO's tenth anniversary. Italy, the Netherlands and Nationalist China had sent aerobatic fighter teams to take part in the military flying displays, and three Avro *Vulcans* from the Royal Air Force's No. 617 Squadron were also to be seen in some of the demonstrations.

So much for the general agenda... A glance at the programme reveals that the Aircraft Industries Association of America was not among the official sponsors and that Boeing Airplane Company, for example, did not figure in the list of exhibitors. Foreign exhibitors totalled just four—Canadair Ltd. (Canada), Générale Aéronautique Marcel Dassault (France), Rolls-Royce and Lucas-Rotax (Britain)—compared with some 200 American companies. If a few European firms did decide to take part, this was doubtless thanks primarily to the personal charm of Miss Jacqueline Cochran (alias Mrs. Floyd Odlum, the well-known airwoman and President of the Fédération Aéronautique Internationale). Just the same the title "World Congress" appears slightly grandiose, despite the substantial attendance of foreign military delegations.

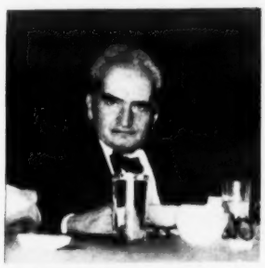
At any rate the New World was certainly well represented: the round dozen different conferences on the jet age, space age, missile management, etc. listed approaching a hundred lecturers (including such well-known speakers as Sir William P. Hildred, Stuart G. Tipton and Walter Binaghi) and 3,500 participants. In addition there were countless models and mockups on the 200 stands inside and outside the exhibition building (including the *Atlas*, *Thor-Able*, *Mace*, *Bomarc*, *Snark* and a wooden mockup of the X-15). Finally there were something like two dozen real live civil and military aircraft to be seen at the airport, in particular the U.S. airlines' new jets and turboprop transports. Las Vegas had armed itself well for the Congress—and for later gatherings—and invested some $6,000,000 in a new Convention Center.

In the general verdict the highlights of the Congress were the USAF's flying displays over Nellis AFB and

* Las Vegas (population 55,000) is situated in the southern tip of Nevada, near Lake Mead and the 726-ft. high Hoover Dam. The city modestly calls itself "The Entertainment Capital of the World" and today has 15 resort hotels and 38 commercial hotels plus 286 motels, with a total of 11,810 rooms... and a goodly array of casinos and night clubs. No fewer than 26,899 marriages were performed in 1958, but the total births were a mere 3,163. Finally Las Vegas is well provided with airfields: McCarran Field (civil airport on the outskirts of the city), Nellis AFB (15 miles away), Indian Springs AFB (45 miles away)... and is "only" 295 miles from Los Angeles.

Some prominent visitors

General Curtis E. LeMay, Vice Chief of Staff.



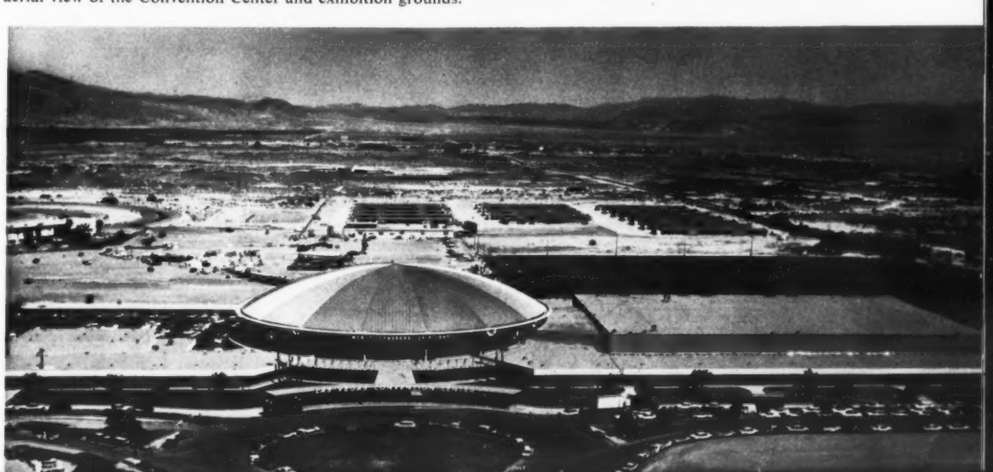
Professor Theodore von Kármán, Chairman of AGARD.

Miss Jacqueline Cochran, President of the Fédération Aéronautique Internationale.

Donald Douglas Jr., in front of a 50-ft. model of the DC-8.

Th. G. Lanphier, Chairman, National Aeronautic Association (left) and Dr. Edward Teller (centre).

The Air Force Association's banquet to mark the tenth anniversary of NATO was attended by military delegations from eleven member countries. Upper picture shows Prince Bernhard of the Netherlands (left of the rostrum) and Secretary of the Air Force James H. Douglas with Professor von Kármán (right of the rostrum), also (top row, centre) General Thomas D. White (Chief of Staff) and Lieutenant General J. Kammhuber (German Air Force). Lower picture: an aerial view of the Convention Center and exhibition grounds.

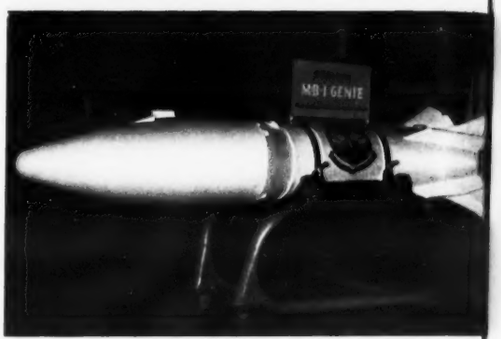


Republic F-105 *Thunderchief* supersonic fighter-bomber with air brakes open during a low pass over Nellis AFB . . .

. . . and taking on ammunition for its General Electric T-171 *Vulcan* six-barrel 20-mm cannon.

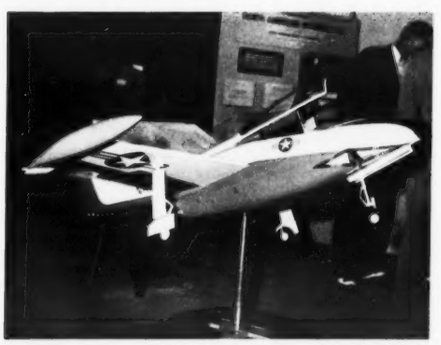
Convair B-58 *Hustler* supersonic bomber taking off . . .

. . . and on the airfield.



The Douglas MB-1 *Genie* atomic air-to-air rocket, standard weapon on the Convair F-106 interceptor, costs roughly a quarter million dollars (complete with nuclear warhead).

Space age mockups, left to right: North American X-15 (of "all-wooden" construction), Northrop *Snark*, Douglas *Thor-Able*, Lockheed *Discoverer* satellite, Convair *Atlas*.



Model of the new T2J naval jet trainer on the North American Aviation stand.

Canadair exhibited a model of the CL-44 turboprop freighter (with folding nose): operating costs are less than 4 cents per short ton-mile.

Joint appearance of civil and military aircraft at McCarran Field. Front row, left to right: Republic F-105 supersonic fighter-bomber, Convair F-106 supersonic interceptor, McDonnell RF-101 photographic reconnaissance aircraft, Lockheed F-104 interceptor, Convair F-102 all-weather interceptor, Douglas B-66 tactical bomber, North American F-100C fighter-bomber. Second row, left to right: the RAF's de Havilland *Comet 2* military transport and Avro *Vulcan* bomber, the USAF's Lockheed EC-121 radar early warning aircraft, Boeing B-47 bomber, Boeing KC-135 jet tanker/transport. The third row contains the Boeing 707-120 (far left), Douglas DC-8, Convair 880, Lockheed *Electra*, Fairchild F-27, Canadair/Convair 540 and Convair 440.

its gunnery range, and the Air Force Association's Banquet to celebrate NATO's tenth anniversary, both held on April 15th. At Nellis the USAF's Tactical Air Command made a first public demonstration of the Republic F-105 fighter-bomber which showed toss bombing of a 750-lb. atom-bomb mockup from low altitude, while the Air Defense Command fired *Sidewinder* homing rockets at towed targets. Strategic Air Command, NATO's "big stick", showed a Convair B-58 supersonic bomber taking off and demonstrated the dropping of a 4-ton H-bomb mockup (which "exploded" at an altitude of 1,000 ft.) by a Boeing B-52. In brief, it was an event of the heaviest military calibre which, including the aerobatic displays by various fighter squadrons, took up a full 2½ hours on the Wednesday morning.

It was therefore not surprising that *Prince Bernhard of the Netherlands*, who was principal speaker at the NATO Banquet in the evening of the same day, should have paid tribute to the important part SAC and the whole USAF has played in maintaining the "balance of forces" in the world during the past ten NATO years. The banquet (see picture) was attended not only by the heads of the USAF (Secretary of the Air Force James H. Douglas, General Thomas D. White), but also by prominent personalities from the American scientific world (Prof. von Kármán, Dr. E. Teller) and industry (too many to enumerate), as well as by military delegations from eleven NATO countries.

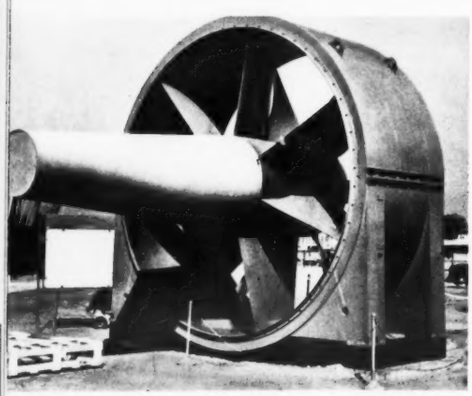
Another interesting feature was the joint appearance of *all the new American turbine-powered airliner types* at McCarran Field, as illustrated in the accompanying full-page picture. Lined up from front to back are the Fairchild F-27 (built under Fokker licence), Lockheed *Electra*, Convair 880, Douglas DC-8 and finally an American Airlines Boeing 707.

The 1959 German Air Show Hanover

The joint stand taken by Flugzeugunion Süd (Ernst Heinkel Flugzeugbau GmbH and Messerschmitt AG).

Autoflug Gerhard Sedlmayr GmbH showed Irvin parachutes and parachute accessories, Martin-Baker ejection seats and other escape equipment.

Multi-channel magnetic tape recorders for air traffic control use and automatic public address systems figure on the production programme of Wolfgang Assmann GmbH.



Voith GmbH supplied this fan for the DFL's 9×11.8 ft. wind tunnel at Brunswick.

The Siemens & Halske AG and Siemens-Schuckertwerke AG stand.

The German Federal Republic did not regain air sovereignty until May 1955, but by the spring of 1958 the country was already able to organize its first aircraft exhibition, of purely national character, at Hanover. The second show has just been held, now on a broadening basis, and with a more international flavour.

The speakers at the official opening of the Show, however, apparently did not quite agree on the scope of the exhibition: Alfred Kubel, Lower Saxony's Minister of Economics—who is ultimately responsible for the Hanover Trade Fair and the attendant Air Show—spoke of an *international* event, while Dr. L. S. Rothe, Chairman of the Bundesverband der Deutschen Luftfahrtindustrie (German Aircraft Manufacturers Association), stressed the *national* character of the Show; finally, Professor Ludwig Erhard, Vice Chancellor and Federal Minister of Economics, sounded a distinctly sobering note: "... In the aircraft industry, too, we must beware of losing our heads in the clouds, and must ... keep both feet on the ground. We must clearly recognize what we can reasonably and usefully undertake, and avoid any attempt to leap ahead beyond our powers." Such was the note sounded at the beginning of the 1959 Air Show.

The number of foreign exhibitors was not overpowering. Those who did take part were motivated either by a feeling of solidarity or by commercial considerations, since the Federal Republic is much courted as a customer in the armaments market. One major British engine manufacturer withdrew from participating at the last moment. Apparently the scope of the exhibition did not meet the wishes of all exhibitors.

Turning to the German participants, we find that Flugzeugunion Süd (Heinkel and Messerschmitt), Dornier, Focke-Wulf and even the financially bedevilled BMW-Triebwerkbau were all represented by impressive stands, though such highly capitalized companies as Weser-Flugzeugbau (Krupp, with a percentage of the shares held by United Aircraft) and Hamburger Flugzeugbau were absent. Why? Admittedly the chief emphasis of the show was on the civil side, and the absent

Panorama of the static aircraft show at Hanover-Langenhagen Airport.

companies are engaged mainly on military production under licence . . . but the same applies to Flugzeugunion Süd.

Basically, all the German companies have fully grasped the fact that no aircraft industry can live on civil business alone, and all planning is centred around the sum of over a billion Marks with which the Federal Defence Ministry proposes to set the industry on its feet in the coming months. Admittedly, a billion Marks is a goodly sum, but by international standards it is merely a drop in the bucket, roughly the cost of a few dozen modern combat aircraft, not to speak of missiles.

In these circumstances the courage with which the German industry is tackling the reactivation of its factories calls for admiration and justifies generous Government assistance. In the opinion of both German and foreign experts, the technical staffs of these companies are entirely equal to the task, despite the emigration of numerous engineers and scientists. What of the management side? Claudius Dornier, who celebrated his 75th birthday on May 14th, 1959, is the only member of the old brigade who has succeeded in emerging from the ruins through his own efforts and with his own resources, and in passing on his work to the second generation. Some of the other companies still need considerable overhauling. Aircraft engine manufacturers at the present time exist mainly on paper; they need financial reorganization and must be re-equipped. And the German Aircraft Manufacturers Association must now show whether it can compete on even a modest scale with the industry associations in the United States, Britain, France or Italy.

Examples from the Focke-Wulf manufacturing programme.

A tour of the Exhibition

During the eleven days from April 25th to May 5th, 1959, a total of 107 German and foreign companies showed their wares in the new, 140,000 sq.ft. exhibition building at Hanover-Langenhagen Airport. As the accompanying pictures reveal, civil products predominated, since the organizers had stressed the trade fair side of the show.

On the apron outside the exhibition building visitors could inspect—or fly—16 German sports and touring aircraft, including the production Dornier Do 27, Focke-Wulf/Piaggio FW/P.149 D and Klemm Kl 107B, as well as designs by the firms of Pützer, Rhein-Flugzeugbau, Scheibe and Stark. The German representatives of foreign manufacturers showed 15 sports and touring aircraft, among them Italy's Falco F8 L and Piaggio P.166, America's Helio H 391B *Courier* and models from the Beech, Cessna, Mooney and Piper stables.

Inside the exhibition building the scene was dominated by the stands of Flugzeugunion Süd (Ernst Heinkel Flugzeugbau GmbH, Speyer, and Messerschmitt AG, Augsburg), Dornier-Werke GmbH, Munich, and Focke-Wulf GmbH, Bremen. In the engine section, BMW-Triebwerkbau was represented by the Lycoming GO-480, which it is manufacturing under licence, and by its own BMW 6002 small gas turbine; and Porsche KG showed its range of small aircraft engines of up to 75 h.p.

Then considerable space was taken up by the equipment and accessories industry, which also provided by far the largest number of exhibitors.

It is obviously impossible, in so short an article, to detail the long exhibition catalogue of companies such as Siemens & Halske, Siemens-Schuckert, Standard Elektrik Lorenz and Telefunken, who put on a highly varied show both at the main Fair at Hanover-Laatzen and (with the exception of Telefunken) at Langenhagen. The Fair proved that, as in other fields, these companies have again reached world stature in the field of aviation electronics.

Finally, the main Fair buildings also included stands occupied by a large number of German companies who are already suppliers in one form or another to the German and foreign aircraft industry and are waiting for an expansion of the domestic market for aeronautical equipment and accessories.

Equipment companies from the exhibitors' catalogue

Apparatebau Gauting GmbH, Gauting, near Munich: aircraft instruments and various ground equipment;

ATE, Alfred Teves KG, Frankfurt: brakes and hydraulic systems;

Autoflug Gerhard Sedlmayr GmbH, Hamburg: parachutes and parachute accessories, rubber boats, ejection seats (Martin-Baker agents);

Baas GmbH, Hamburg: hydraulic aircraft arrester nets, as already installed at a number of German military airfields;

Robert Bosch GmbH, Stuttgart: ignition systems and other electrical equipment;

Focke-Wulf GmbH, Bremen: undercarriage test beds, oleo-hydraulic working rigs, hoisting and transport equipment;

Linhof KG (Präzisions-Kamera-Werke), Munich: aerial photographic equipment and other optical equipment;

Rheinstahl Hanomag AG, Hanover: aircraft towing vehicles, snow-clearing equipment, etc.;

Rohde & Schwarz Vertriebs GmbH, Munich: Collins navigation instruments;

Siemens & Halske AG, Berlin: telecommunications and measuring equipment for aeronautical use;

Siemens-Schuckert AG, Berlin: airport lighting, warning lights and other products;

Standard Elektrik Lorenz AG, Stuttgart: navigation equipment;

Strüver GmbH, Hamburg: airport fuelling trucks, emergency current generators, starters, etc.;

Techno-Chemie Kessler & Co. GmbH, Frankfurt: hoses, hose couplings, Vacuflex hoses, etc.;

Telefunken GmbH, Ulm: navigation and radar equipment;

VDM, Vereinigte Deutsche Metallwerke AG, Frankfurt: semi-manufactured products of all kinds, light and heavy metals, pressed and forged parts, sintered parts, rivets, etc.

Dornier Do 27: excellent visibility in all directions for both pilots and passengers.

Klemm Kl 107B three-seat sports and touring aircraft (150 h.p. Lycoming O-320).

Rhein-Flugzeugbau RW 3 sports aircraft and powered glider (65 h.p. Porsche 678).

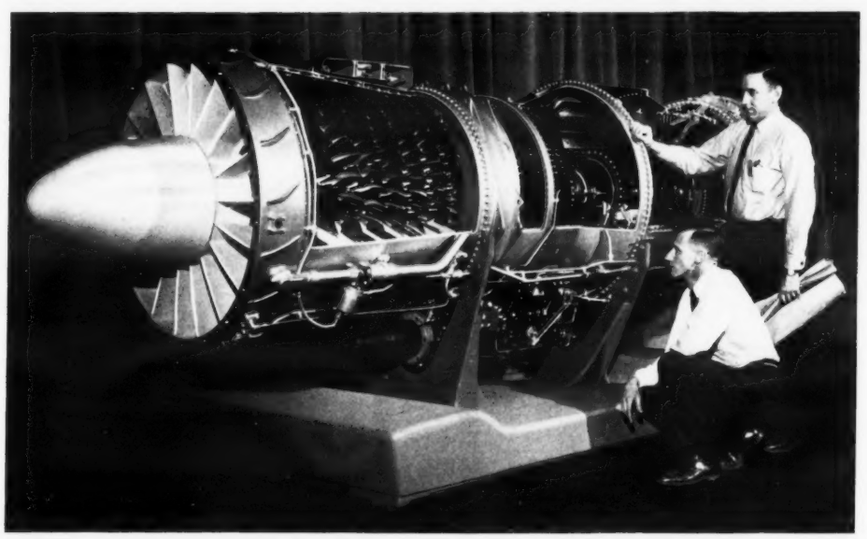
Pützer Elster *sports aircraft with 65 h.p. Porsche engine (above) . . . and the new Pützer* Bussard *with 95 h.p. Continental C-90-12F and long shaft running to the rear pusher propeller (below).*

Dittmar HD.156 Möwe.

Progress in Pictures

Convair's F-106 supersonic all-weather interceptor *is also being built in a two-seat F-106 B version which can be operated both as a type familiarization trainer and a combat aircraft. The first F-106 squadrons will be set up this summer.*

Cutaway model of the JT4 *civil version of the Pratt & Whitney J75 jet engine: The military version of the engine, projected for the Republic F-105 supersonic fighter-bomber and the Convair F-106 interceptor, delivers a thrust of 24,500 lb., which can be increased to 26,500 lb. if water injection is used. By comparison, the military version of the well-known J57 delivers only 16,900 lb. of thrust. Weight of the military J75 with afterburner is 5,875 lb.; length is given as 19 ft. 8 in.; and diameter at the compressor inlet as 43 in. The version without reheat used in the Martin P6M flying boat weighs only 4,960 lb. and is 12 ft. 2 in. long. The JT4 civil version for the Boeing 707 and Douglas DC-8 transports has a thrust of 15,800 lb., though a new model will have roughly 1,000 lb. more thrust. Weight is 5,020 lb. and length 12 ft. 1 in.*



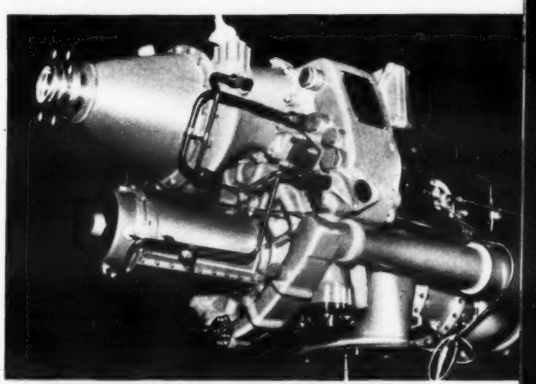
The Goodyear *Inflatoplane, stowed in a 6-ft. cylindrical container, being landed by parachute in the combat zone. The container not only carries the inflatable aircraft's 245-lb. rubber envelope, but also the 60-h.p. four-cylinder engine, the undercarriage, and the gasoline-driven air compressor to inflate the envelope. When the rubber aircraft has been removed from the container it can immediately be inflated and prepared for flight within six minutes. The U.S. Army is testing the* Inflatoplane *concept with the idea of using this unusual vehicle for artillery observation and communications tasks, as well as for the rescue of the wounded. Span of the* Inflatoplane *is 28 ft., and cruising speed 55 m.p.h.*

The Sikorsky S-60 crane helicopter *commenced flight tests several months ago. Powered by two 2,100-h.p. Pratt & Whitney R-2800 engines, this unusual load-carrying helicopter can transport four to six tons over distances of up to 100 miles. If gas turbines are fitted instead of the piston engines, payload can be increased by a further 2.5 tons. The S-60 was developed in cooperation with the U.S. Navy, but will also be used by the U.S. Army (see righthand picture: carriage of an Army* Honest John *artillery rocket).*

The crane helicopter carries its loads on cables beneath the fuselage. The latter consists in essentials of a bridge-like boom of box-shape section, with the cockpit at one end and the tail rotor at the other. The glass-enclosed cockpit offers unobstructed vision in all directions; the co-pilot's seat swivels through 180 degrees to the rear, with flight controls in both forward and aft-facing positions. This provides a clear view of loading and unloading operations and enables the pilots to position the helicopter exactly for hoist work. Also available are especially designed detachable pods to carry weapons, troops or equipment. Other applications: towing of surface vessels, rescue of crews, assistance to bogged-down trucks, etc. Lee S. Johnson, Sikorsky General Manager, revealed during the S-60 demonstration that his company is also working on crane helicopters with lifting capacities of up to 50 tons.

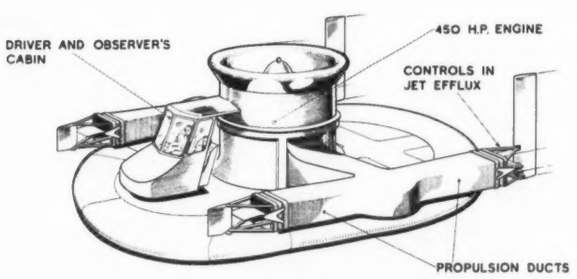
The prototype of the YAO-1 Mohawk *Army observation aircraft took off on its first flight from the Grumman airfield at Bethpage in mid-April. With a weight empty of 9,000 lb., the* Mohawk *is one of the U.S. Army's biggest fixed-wing aircraft, though it has very short take-off and landing distances and a stalling speed of only 59 knots. It is powered by two Lycoming T53 propeller turbines of 1,005 e.h.p. each and has a maximum speed of around 275 knots.*

The Pratt & Whitney JT12 *jet engine is currently being flight tested over a wide altitude and speed range in a special nacelle under the fuselage of a B-45. The engine is to be used, for example, in the Lockheed* JetStar *communications aircraft, McDonnell 119, the North American* Sabreliner, *and Republic and Fairchild target drones. The manufacturers have released the following performance data for the JT12A-1 military version without afterburner: take-off power 2,900 lb.; normal rated power 2,400 lb.; 75% normal rated power 1,800 lb.; power at 35,000 ft. and at Mach 1.8 is 993 lb. A JT12A-20 with afterburner for speeds up to Mach 3 is also under development; max. thrust 3,900 lb.; military power 2,830 lb.; and normal rated power 2,350 lb.; engine weight 645 lb.*



The prototype of the Allison Model 250 *small gas turbine, being developed in various versions for the U.S. Army under the designation T63, commenced flight tests several weeks ago. The mockup (pictured here) of the small and extremely light multipurpose turbine was shown at the Annual Meeting of the Society of Automotive Engineers in New York. All versions have a seven-stage axial compressor and a space-saving combustion chamber configuration with reverse flow. Power of the various versions is roughly 250 s.h.p.; all can operate on JP4, JP5 or JP6 fuel, diesel oil or 115/145 octane gasoline. Also projected is a 250-B turboprop version (operating at 2,057 r.p.m.) and a 250-C turboshaft version (6,022 r.p.m.). The 250-B2 (pictured) has a length of 40.07 in. and a dry weight of 110 lb. The 250-C2 version is 37.31 in. long, weighs roughly 95 lb. and has both fore and aft power output. The 250-C6 version (auxiliary power unit) weighs 106 lb. The Allison Model 250 gas turbine was originally designed for use in light observation aircraft and two-seat helicopters for the Army, but was so far modified during development that it can now meet all requirements in the fields of aircraft propulsion and auxiliary drive.*

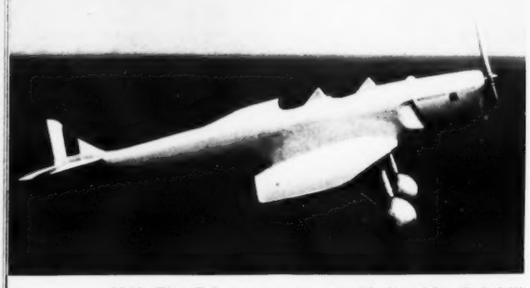
The Saunders-Roe *plant in the Isle of Wight is putting the finishing touches to a new type of hovering vehicle, which can be described as something between an aircraft and a ship. The experimental craft has been designated the SR N1 and has been designed to patents taken out by C.S. Cockerell for a "hovercraft" supported on a "cushion" of air and propelled by a rear jet. The drawing illustrates the hovercraft principle: In the centre of the pontoon-like body (30 ft. × 24 ft.) there is a large ducted fan driven by a 450-h.p. Alvis* Leonides *radial engine. The air flow produced by the fan is used in part to create the air cushion on which the craft moves and in part to feed horizontally-acting jet nozzles for propulsion. The SR N1 prototype will have a crew of two, who will sit in a cabin forward of the ducted fan.*



Fiftieth Anniversary of Fiat-Aviazione

1915: Built under Farman licence, this Fiat-Farman 5B biplane was the first aircraft manufactured by Fiat's SIA branch (Società Italiana Aviazione).

1923: Fiat CR.1 single-seat fighter (designed by Rosatelli) with 300 h. p. Hispano-Suiza engine.



1932: Fiat G.5 sports two-seater (designed by Gabrielli) with 130 h. p. in-line engine.

The name of *Fiat* has an amazing reputation in Italy, not only because it represents the greatest industrial combine in the country and one of the leading concerns in Europe, but because of the prominent part played by this company, which was founded sixty years ago, in the national economy. The principal founder was *Senator Giovanni Agnelli* who controlled its destinies with resolution and vision until his death in 1945. His place at the head of Fiat was taken over by *Professor Vittorio Valletta,* who for twenty-five years had been his intimate associate. While Agnelli had the foresight to create a major industry in Southern Europe that may justifiably be described as a model one, Valletta demonstrates the qualities of a business leader who knows how to adapt himself to present-day realities. It was he who reconstructed the organization in the very difficult conditions of the post-war period.

The aeronautical history of Fiat has evolved over a half-century, only nine years less than that of the automobile division, which is the main concern of the Turin plant. In 1908 Fiat developed the first aircraft engine—the 50-h.p. SA 8/75—which powered the type P and M airships and the Farman aircraft. It was with the 5B version of this French biplane that Italian aircraft manufacture made its beginnings in 1915. In the following year the first aircraft of purely Italian design were produced, and in the course of the first world war both experimental and production aircraft proved their worth. These aircraft were linked with names like Savoia, Pomilio, and Verduzio, the engineers who made these projects possible. In 1918 the associate *Società Italiana Aviazione* adopted the name of *Fiat Aviazione,* and one of Verduzio's right-hand men *Celestino Rosatelli* became Chief Design Engineer. Rosatelli was an eminent mathematician who could call upon a very wide experience. He was responsible for a whole range of bomber and fighter aircraft which formed the hard core of Fiat production between the two

Senator Giovanni Agnelli, founder of the Fiat organization.

Professor Vittorio Valletta, President of Fiat.

Professor Giuseppe Gabrielli, Manager Fiat-Aviazione.

1959: The Fiat G.91 NATO light strike fighter (designed by Gabrielli) in production at Turin.

Fiat BR.20 bomber, with two 1,000 h. p. Fiat A.80-RC.41 engines (1939).

SIA-9B (Società Italiana Aviazione) two-seat reconnaissance aircraft, with 680 h. p. Fiat A.14 engine (1918).

wars. He was joined in 1931 by a pupil of von Kármán—an assistant from the Turin Aircraft Design College, *Professor Giuseppe Gabrielli*. The latter had an ingenious brain backed by unusual knowledge and dogged willpower. On the death of Rosatelli in 1945 he was called to assume the highest responsibilities in the reconstruction of the aircraft industry. In the evolution of the Fiat organization the Aviation Division was formed in 1954 under the direction of Gabrielli. This groups at the present time aircraft and engine design, production and test divisions combining in one body the Avio Group, the commercial technical liaison and inspection departments together with the electronic centre.

Up to the present Fiat has manufactured 54 types of aircraft engines, several of which have been produced in quantities running into several thousands. 162 aircraft types have been constructed including both prototypes and their derivatives. Of the designs created by Professor Gabrielli, 57 were actually manufactured.

*

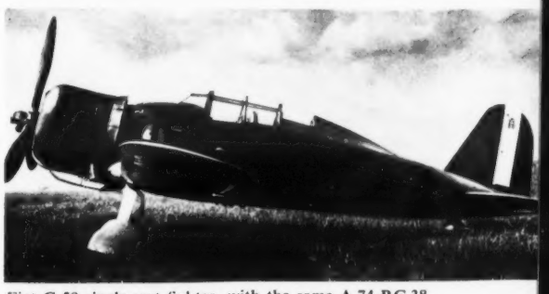
In chronological order the most successful Fiat productions in the engine field are: the *A.12* (1916) —13,000 produced; *A.20* and derivatives (1925–1931) which equipped almost all Italian fighter and reconnaissance aircraft, and which in special versions powered the flying boats which flew from Italy to Brazil under the command of Italo Balbo, and also the Italian racing seaplanes which competed for the Schneider Cup Trophy; the *AS.6*, with which in 1934 Agello set up the still unbeaten seaplane record of 383 knots (709 km/h), in a Macchi MC. 72; the *RA. 1050* produced in large numbers for fighter aircraft of the second world war. In addition to these engines there was a wide range of engines for light aircraft, of which the *A. 50*, designed in 1929 for a maximum power of 100 h.p., was the most outstanding.

After World War II the engine shops were largely devoted to the licence production of the de Havilland *Ghost* (1951), but since 1955 have gone over to experimental turbojets of their own design. Chief types have been the *4002.000* and *4002.001* of 550 lb. and 660 lb. of thrust respectively, the *4032* of 6,600 lb. thrust, and the *4700* gas turbine compressor. In addition, spares have been manufactured and maintenance work undertaken on General Electric J47-GE.17B jets.

*

The aircraft achieving the greatest success in the early period were: the types SP and variants and SIA (1915–1917), among which were the SVA (1917–1921) whose qualities were proved outstanding during war and other important operations such as the Rome–Tokyo flight by Arturo Ferrarin (1920) and the Andes crossing by Antonio Locatelli. The BR bombers and the CR fighters in their numerous successive versions comprised the main part of the Italian Air Force from its creation in 1923, up to the early stages of the second world war. The A. 300/4 reconnaissance aircraft, which equipped the air observation squadrons in the first years; the light ASI touring aircraft. The first Fiat monoplane—a small three-engined civil aircraft—was the G.2, designed by Professor Gabrielli in 1931. This was followed by the G.5 light touring aircraft. The "G" fighter series began with the G.50, which flew in 1937, and 700 of which were manufactured in various versions. The G.55 (1942) was a high-speed fighter

Fiat CR.42 single-seat fighter, with 850 h. p. Fiat A.74-RC.38 engine (1937).



Fiat G.50 single-seat fighter, with the same A.74-RC.38 engine (1937).

Fiat G.55 single-seat fighter, with 1,250 h. p. Fiat RA.1050 engine.

The 1932 G.2 three-engine touring aircraft (total power approx. 400 h. p.).

intended for production but was cancelled because of political developments. With the end of hostilities the company resumed production of the G.55 fighter and G.59 variant for training and instruction purposes; 175 of this latter aircraft were absorbed by the internal market and by exports.

In the civil field the most outstanding Fiat aircraft were: the twin-engine, 18-passenger G.18 (1935); the APR 2 in the same category (also 1935); the G.18V (1937) and the G.12, over 100 models of which were produced (1940). Soon after the war (1947) the G.212 and a lengthened G.12 L version flew as four variants with different engine arrangements.

Entered into the jet era, Fiat manufactured Professor Gabrielli's types G.80 and G.82 for

Fiat G.59 two-seat fighter trainer, with 1,630 h. p. Rolls-Royce *Merlin* engine.

Fiat G.80 jet trainer, with de Havilland *Goblin*.

Fiat G.91 light strike fighter, with Bristol *Orpheus*.

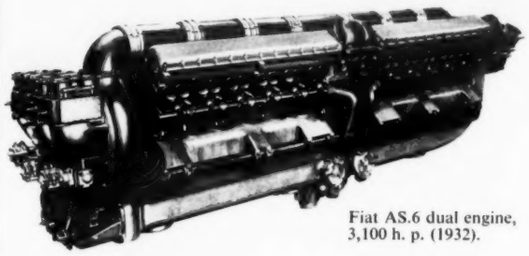
Fiat G.46 two-seat trainer for the Italian Air Force.

1908—1959

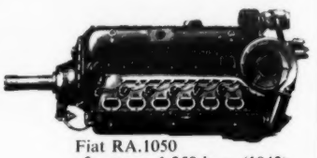
Typical Fiat aircraft engines

First Fiat engine, the 50 h. p. AS.8/75 (1908).

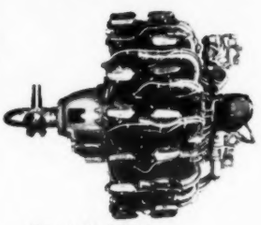
Fiat A.22 of approx. 600 h. p. (1935).



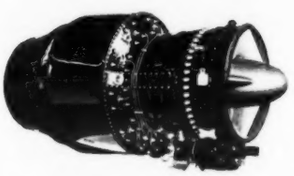
Fiat AS.6 dual engine, 3,100 h. p. (1932).



Fiat RA.1050 of approx. 1,250 h. p. (1942).



Fiat A.80-RC.41 of approx. 1,000 h. p. (1936).



Fiat 4032 jet engine for 6,600 lb. thrust (1958).

Fiat 4700 gas turbine compressor (1959).

training purposes. Meanwhile, the de Havilland *Vampire* was in quantity production under licence, and Fiat was cooperating with North American in the manufacture and assembly of the F-86K, required for all-weather fighter squadrons of the principal western air forces.

At the same time the Avio Group obtained orders for the manufacture of spare parts for Sikorsky S-58 helicopters and the twin-jet *Caravelle*, and production of the Fiat 7002 helicopter of their own design was starting.

The G.91 merits a particular mention. It is the first aircraft design to completely meet a NATO specification. In its combat, training and reconnaissance versions it forms a whole "family" of light tactical jet aircraft intended to provide the answer to fundamental problems of air support for land forces. This aircraft is outstanding because of its lightness, power and range of armament, extremely modern systems and flight instruments, speed, facility to operate from improvised landing strips, manoeuvrability at all speeds and at all altitudes, ruggedness, and range. All these qualities do great credit to its designer, Professor Gabrielli. The G.91, in production for several NATO countries, is progressing favourably. A few figures will serve to ilustrate the efficiency of this aircraft. On grass surfaces without external loads the G.91 takes off in approximately 2,000 feet, with external loads this distance becomes 2,600 feet; 70 seconds after the beginning of the run the aircraft attains its optimum climbing speed, that is to say M = 0.75. This speed is maintained only up to a height of 3,300 feet—the cruise altitude required for a typical mission. For a high altitude mission the G.91 can climb to 30,000 feet in 5 minutes 30 seconds. The approach to the target is made largely at the attack speed of M = 0.9. The aerodynamic brakes can be used at any flight speed: if they are operated at 350 knots, a typical speed for a raid, the deceleration is about 0.4 g. The aircraft design enables excellent evasive tactics to be adopted. A remarkably high rate of lateral manoeuvrability (200°/sec) remains, even at maximum speeds.

In addition to the conventional armament consisting of several combinations of 0.50 calibre machine guns and 20 or 30 mm cannons, together with guided and unguided rocket missiles, the installation of two Nord 5103 air-to-surface missiles, one under each wing, is being examined, as well as three de Havilland air-to-air infrared *Firestreak* missiles positioned one under each wing and one beneath the fuselage.

The G.91 order benefits foreign licence holding manufacturers, also British and French suppliers of engines and spare parts, and two of the most important Italian companies—Piaggio and Siai Marchetti—who are participating in production.

*

These last fifty years form only one chapter of an unfinished record of progress. As Professor Valletta said recently "Fiat has already some new production programmes, new designs, plans for expansion and European collaboration."

Today in the Aviation Division there are engineers well qualified to create the aircraft of tomorrow.

Rockets, Missiles and Space Vehicles

• Details of the Discoverer II launching

The following details of the U.S. polar satellite *Discoverer II*, which was successfully launched on April 13th, 1959, have now been released. The satellite contained a recoverable capsule and is described as the forerunner of later military satellites designed to be recovered after use.

The first stage of the vehicle was a standard *Thor* IRBM modified at the nose to take the second stage. Weight was more than 100,000 lb., and height, including adapter for the second stage, was 66.7 ft. The single-chamber Rocketdyne liquid-propellant engine delivered a thrust of 150,000 lb. Pitch and roll control was provided by a tape recorder programmer and an autopilot for attitude stabilization. The second stage, developed by Lockheed, incorporated a Bell liquid-propellant engine of roughly 15,000 lb. thrust and carried in its tip a variety of radio and measuring equipment, a data transmission set and the recoverable capsule. This second stage was 19.2 ft. long, had a diameter of 5 ft. and weighed about 8,400 lb. on ignition. After burnout, the weight of the second stage was roughly 1,600 lb. Of the latter total, 440 lb. was accounted for by the payload, distributed as follows: 245 lb. for radio equipment, telemetry and instrumentation for measuring the performance of the satellite, and 195 lb. for the actual re-entry vehicle.

An Air Force spokesman has described the objectives of the second *Discoverer* launching as follows: to check launching techniques, propulsion, orbital performance and recovery techniques. The vehicle was launched from Vandenberg AFB, California, on an almost southerly bearing (183°). The second stage was programmed into a horizontal position (parallel to the earth's surface) after separation from the first stage. During the coasting period between burnout of the first stage and ignition of the second stage, radar at Point Mugu, California, determined the exact position of the second stage and gave the command for ignition.

The guidance and control system included an inertial reference package, an infrared scanning device, a pneumatic jet control system and a hydraulic control system. The inertial reference package and the pneumatic jet control system, aided by the infrared scanner, combined to place the second stage in a horizontal position prior to ignition of the Bell engine. Upon ignition, the hydraulic control system took over, gimballing the engine to maintain the satellite in a horizontal position. The infrared scanner continued to operate, relaying corrections to the second stage guidance system. After burnout of the Bell engine, the pneumatic jet control system again came into operation. Compressed gas under high pressure was then metered to a series of external jets, which positioned the satellite as it orbited the earth.

The projected recovery of the instrumentation capsule—later found to be impracticable—was to have taken place as follows: once the recording instruments inside the capsule had collected sufficient data, the compressed gas jets were to have manoeuvred the whole satellite into position for ejection of the capsule, whereupon explosive bolts and springs would have accomplished the separation. As already stated, total weight of the recoverable capsule was 195 lb., including the retro-rocket and other recovery aids, or 160 lb. without these. In later launchings it is planned to carry animals in the capsule, but in the *Discoverer II* the container was filled with equipment to ascertain conditions inside the capsule and record the forces acting on it. For the actual recovery of the capsule (suspended from a parachute) eight C-119s of the 6593rd USAF Test Squadron were made available. The aircraft would have had ten minutes in which to catch the package as it fell through the altitude range in which they were operating. A trapeze apparatus suspended by nylon ropes from the rear of the aircraft was to have been used to snatch the descending parachute, which could then have been reeled into the aircraft.

The attempt to recover the instrumentation package in the Hawaiian area was abandoned when it proved impossible to actuate the separation mechanism at the desired time—despite the fact that the separation command was given from the ground as programmed. However, after the 17th orbit, on April 14th, the capsule was automatically ejected from the satellite, as previously scheduled. An analysis of radar and radio beacon signals appears to have revealed that the capsule was released in good order over the North Pacific and came down somewhere near the North Pole. Although search squadrons stationed in Alaska were immediately alerted, the valuable capsule does not appear to have been found.

For tracking and telemetry purposes in connection with the *Discoverer II* experiment special stations were set up at Vandenberg AFB and Point Mugu, on two telemetry ships, on Kodiak and Annette Islands off Alaska and on Kaena Point, Hawaii.

• Canadian satellite in 1961

Joint announcements made in Ottawa and Washington say that Canada, in cooperation with the United States, will launch a satellite in 1961 to study the upper layers of the ionosphere. Design and construction of the instrument package will be a purely Canadian project to be undertaken by a team of scientists from the Defence Research Board. The satellite's shell and the rocket vehicles required to launch it into space will be provided by the United States.

The Douglas rocket vehicle with the *Discoverer* satellite at its tip shortly before launching from Vandenberg Missile Center, California. The entire *Discoverer* programme is being directed by Lockheed's Missile and Space Division in cooperation with ARPA; the technical and administrative offices for the project are housed at Lockheed's Palo Alto Scientific Research Laboratory.

This mockup of the Navy's *Polaris* IRBM was used to test the surface launch system under ship motion conditions at Cape Canaveral and has now been presented to the U.S. Naval Academy, Annapolis, Maryland.

A Defence Research Board spokesman has said that four instrument packages will be built; one will be used for laboratory testing, the second will be tested to destruction by firing in a rocket, the third will be used in the orbit shot, and the fourth will be a spare. It is hoped that the satellite will be able to relay information from a north-south orbit just above the ionosphere for a period of about twelve months. The instrument package will be completely transistorized and will be powered by solar batteries.

● Details of the Martin Titan ICBM

The Martin Company, main contractor for the WS-107A-2 weapons system, has released first details of the two-stage SM-68 *Titan* ICBM. Length is more than 90 ft., and launching weight roughly 220,000 lb. —less than that of the *Atlas* ICBM. Even when it carries the heaviest nuclear warhead yet designed, range is more than 5,500 nautical miles. The first stage has a length of 54 ft. and a diameter of 10 ft. The Aerojet XLR87-AJ-1 rocket in the first stage, an individually controllable twin-chamber unit, delivers a total of 300,000 lb. of thrust. The second stage, including the warhead, is 37 ft. long and has a diameter of 8 ft. High altitude thrust of the Aerojet XLR91-AJ-1 second stage motor is 80,000 lb.

Development of the *Titan* ICBM began in October 1955. At the present time Martin holds *Titan* contracts valued at a total of $384 million. So far four successful test launches have been made, on February 6th, February 25th, April 3rd and May 4th, 1959. On all these occasions, successful tests were also made of the Master Operations Controller developed by Martin's Denver Division, which checks all missile systems before launch and automatically analyses any functional disorders. The test launchings were all made with a dummy second stage filled with 45,000 lb. of liquid ballast. The last two *Titans* had a radio/inertial guidance system developed by Bell Telephone Laboratories, which continuously reported position and speed back to the ground. It is also announced that the Air Force Ballistic Missile Division has awarded A. C. Spark Plug Division of General Motors a contract for development of a new inertial guidance system for the *Titan*. The basic concept for this extremely accurate guidance system stems from Dr. Charles Draper, of the Massachusetts Institute of Technology. The system will replace the Bell installation in the production *Titan*.

● Atlas D detonated after launching

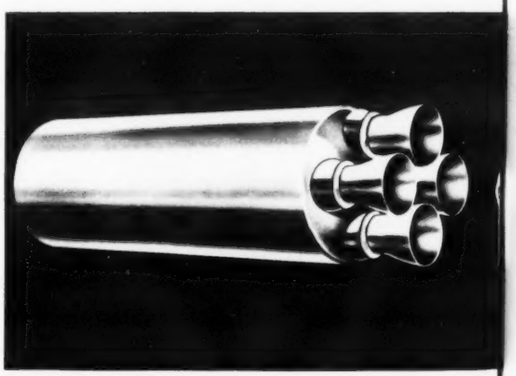
A Convair *Atlas D* intercontinental ballistic missile of the latest version, launched from the Atlantic Missile Test Center in mid-April, had to be detonated by the safety officer 15 seconds after lift-off "owing to technical difficulties". Flaming debris from the 80 ft. missile caused a number of small fires in the launching area. Reportedly this was one of the first of the "D" Series of *Atlas* weapons, which are scheduled for operational service this summer. In mid-May another *Atlas D* was launched, the first ICBM to be fired from the Pacific Range at Vandenberg AFB, California. This was also the first practice firing of an intercontinental missile by an SAC squadron.

● Testing the North American 1,000,000-lb. thrust rocket

The USAF announces that the Rocketdyne Division of North American Aviation has made the first successful test run of a new liquid-propellant rocket engine chamber of more than 1,000,000 lb. thrust. The test was made under an extensive ARPA programme aimed at developing as soon as possible a single-barrel rocket engine with a thrust of 1,500,000 lb. for the launching of manned satellites and space vehicles.

It is also reported that the first stage motor for NASA's *Saturn* vehicle is scheduled to begin testing before the end of the year; first free flight tests are due in the autumn of 1960. The power unit concerned will consist of a cluster of eight Rocketdyne liquid-

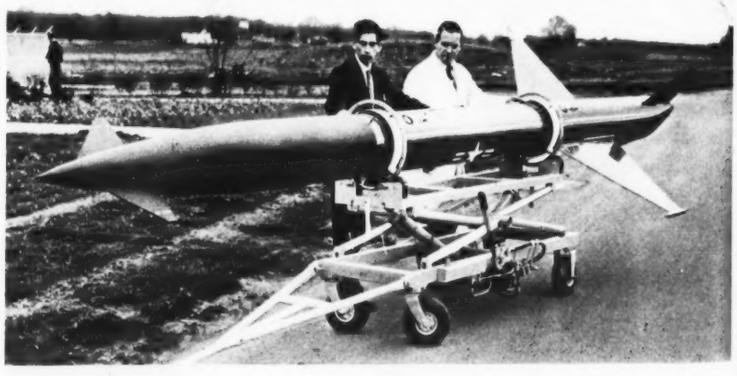
A new version of the Philco *Sidewinder* air-to-air rocket has been ordered by the Swedish Air Force as standard armament for its Saab-35 *Draken* supersonic fighter and Saab-32 B *Lansen* two-seat all-weather fighter. The *Draken* can carry two or four of these weapons (which have been purchased in large numbers by the U.S. Navy) on special mounts beneath the wings and fuselage.



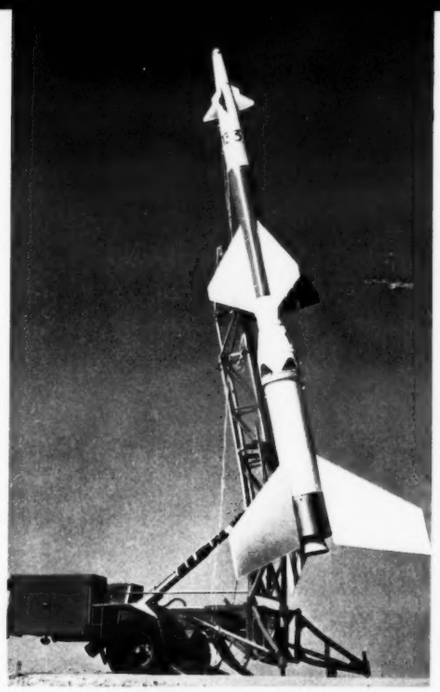
Artist's impression of the projected Aerojet-General four-barrel solid-propellant rocket motor for a thrust of 1,000,000 lb.

A full-scale model of the *Mercury* manned satellite gondola has been submitted to tests in the wind tunnel at NASA's Langley Research Center, to determine drag, lift and stability behaviour of the conical vehicle. These tests form part of an extensive programme of experiments designed to determine the best shape for the *Mercury* capsule. NASA's centre on Wallops Island, Virginia, the Ames Research Center, California, and the USAF's Arnold Engineering Development Center at Tullahoma, Tennessee, are also involved in the programme.

First picture of the Bendix *Penny 1 C* supersonic target drone. The rocket-powered drone can be operated at both low and high altitude, is launched in flight by a carrier aircraft and is described as expendable. *Penny* equipment includes a Bendix radar lens (a plastic sphere for increased reflection of bistatic and monostatic radar signals in the X-band), a radar repeater beacon for increased reflection in the L and S-band, an infrared radiation amplifier and an electronic hit and miss distance indicator.



To facilitate the handling of the English Electric *Thunderbird* surface-to-air missile, Materials Handling Equipment (Great Britain) Ltd., of London, has developed a special side operating fork lift carrier known as the *Kestrel* to transport the cased missile, deposit it near the launching ramp, and finally, when the warhead and fins have been fitted, lift it onto the launcher. Materials Handling Equipment Ltd. manufactures its *Kestrel* vehicles under exclusive licences from the firm of Otis Elevator Company, New York.



A MATRA R.422-B two-stage surface-to-air missile ready for launching on its Decauville transporter. The weapon, which has been built and tested in limited numbers, was designed for an operational range of 8,000 to 18,000 yards and reaches speeds of over Mach 2. The B2 version has an effective operational radius of 30 miles. Launching takes place almost vertically, and guidance is provided by a SFENA radio command control system on the ground (frequency 240 Mc/s) which continuously tracks the position of both missile and target by radar. For the final approach phase a SFENA semi-active radar guidance system is provided (frequency range 2,700–3,100 Mc/s). The solid-propellant rocket booster and the sustainer motor (also solid propellant) are manufactured by SEPR.

propellant engines, each with a static thrust of 123,200 lb. This is in effect an advanced model of the rocket engine used in the *Jupiter* IRBM.

● **Aerojet 1,000,000-lb. thrust solid rocket?**

Dan A. Kimball, President of Aerojet-General Corporation, has announced that his company is investing $250,000 in a feasibility study of a solid-propellant rocket motor that will develop one million pounds of thrust. Aerojet is convinced that it is possible to develop a solid-propellant motor producing such great thrust, in view of the considerable progress the company has made in recent years in increasing the specific impulse of solid propellants.

● **Project Orion**—not to be confused with the original designation for the USAF's airborne medium-stage ballistic missile—is the name of a secret ARPA research programme whose ultimate aim is to accelerate heavy space vehicles to the required orbital velocity by means of successive explosions of small nuclear warheads. Companies working on the project include General Atomic Division of General Dynamics Corporation. Reportedly vehicles weighing some 1,000 tons could be propelled in this way.

● **Transit and Tyros** are the names of two new weather reconnaissance satellites being developed by Space Technology Laboratory, California. The satellite carrier in both cases will be a two-stage *Thor-Able*.

● **NASA's Javelin rocket:** A new four-stage solid-propellant rocket, named *Javelin*, designed for high altitude research and re-entry tests, is shortly to be fired from NASA's Wallops Island base. The individual stages are built up of combinations of *Sergeant* rockets and the *Vanguard* third stage.

● **NATO exhibition of French missiles**

The British exhibition of missiles held several months ago in Paris under NATO patronage was followed in April by a similar exhibition of French missiles at SHAPE, Rocquencourt. Although this display was open only to military experts, *Interavia* understands that the following weapons were shown:

- The Nord-Aviation SS.10 and SS.11 and the Sud Aviation *Casseur* short-range surface-to-surface missiles.
- The Nord-Aviation CT.10 and CT.20 subsonic target missiles; also the CT.40, a target drone designed for high supersonic speeds and fitted with a ramjet and two auxiliary power units.
  Sud Aviation also showed its ramjet-powered SE.4200 and SE.4500.
- The Nord 5103 and MATRA 511 air-to-air missiles.
- DEFA'S *Parca* and two-stage MATRA 422 surface-to-air missiles.

The exhibition also included numerous electronic equipments for guidance and for the detection of enemy missiles, etc.

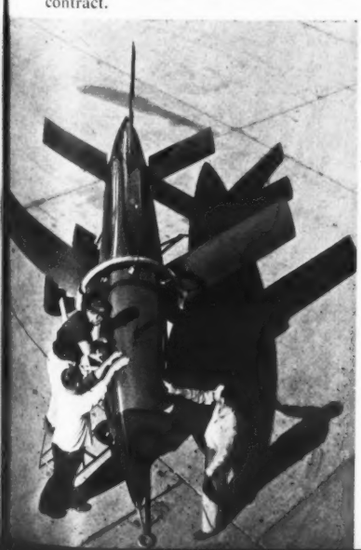
● **The George Washington Polaris submarine**

The U.S. Navy's first ballistic missile submarine, the nuclear-powered *George Washington*, will be launched at Groton, Connecticut, on June 9th; this is the sixth nuclear submarine to be produced by General Dynamics Electric Boat Division, and follows the *Nautilus*, *Seawolf*, *Skate*, *Skipjack* and *Triton*.

The *George Washington* is 380 ft. long and about 6,700 tons submerged. It will become operational in 1960, at the same time as the *Polaris*. The vessel will also have a conventional torpedo system, and will be equipped with SINS (Ships Inertial Navigation System).

● **NASA contracts:** In March 1959 NASA obligated over $10 million for a wide range of space work, including new high-energy rockets, television cameras and manned space flight. Major contracts were awarded to: General Electric Company, $4,120,000, for a second stage liquid-propelled rocket engine to be mounted on an *Atlas* as "Project Vega"; NASA Jet Propulsion Laboratory, $3 million, for "Vega" integration, payloads and technical project supervision; Bell Aircraft Corporation, $1,070,000, to investigate the feasibility of high-energy fluorine-liquid hydrogen rocket engines.

The Ryan Q-2C target drone, a development of the well-known KDA-4 *Firebee*, is now being produced in quantity for the U.S. Air Force under a $10 million contract.



A MATRA R.511 air-to-air rocket being tested beneath the wing of a *Canberra*. The missile, which is 10 ft. 2 in. long and weighs 396 lb., is guided by either an infrared homing head or a radar homing head and can be used against air targets at distances of up to 7,000 yards.

The Temco XKDT-1 target drone is powered by a long-burning rocket motor and is used primarily for the training of fighter pilots. Picture shows an XKDT-1 beneath the wing of a McDonnell F3H *Demon* Navy fighter.

What's in the Air?

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AIR TRANSPORTATION

● **Members of Congress** have received a report from a group of airline pilots expressing the belief that foreign airlines are threatening to overtake United States supremacy in international air travel. The report, which has been compiled by a group of Pan American World Airways pilots in their own time and at their own expense, points to a steady increase in foreign airlines' passenger carrying between the United States and Europe; the report said that the United States' share of this lucrative North Atlantic traffic was 74 percent in 1949, but has now dropped to 40 percent, although 70 percent of the traffic is generated in the United States. If this trend continues, the two United States carriers serving Europe, Pan American and Trans World Airlines, may eventually finish up with only 30 percent of the traffic. The report proposed a slow-down on United States privileges for foreign carriers, or permission for Pan American to operate within the United States instead of exclusively overseas as at present.

● **Evidence to support the PAA pilots'** recent report to Congress on the question of the United States share of North Atlantic traffic is provided by the British Overseas Airways Corporation's claim that it now enjoys second place to PAA in this traffic, having recently displaced the other U.S. carrier, Trans World Airlines. BOAC recorded a 54 percent increase in passenger loads over the 1958 figures in the first quarter of 1959, on services from the United Kingdom to points in the States; on London–Montreal services, first-class and economy-class bookings were up by approximately 50 percent. The British Corporation is forecasting a 42 percent overall increase in passenger business compared with 1958. Advance bookings on the London–New York run are up 100 percent for first-class passengers and 30 percent for economy-class travel, compared with 1958.

Andrei Tupolev, Soviet aircraft designer, was awarded the FAI Gold Medal at the annual conference of the Fédération Aéronautique Internationale (FAI), held in Moscow at the end of May.

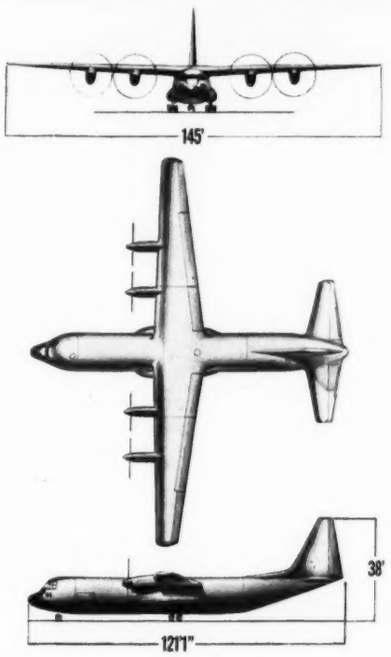
● **Frederick B. Ayer & Associates, Inc.** is offering the 45 Douglas DC-6 aircraft contracted for purchase from American Airlines at the following prices: DC-6 54-passenger model $575,000; 80-passenger model $625,000; DC-6B 62-passenger (1951) model $700,000; 1953 model $775,000; DC-6A all-cargo carrier $875,000. To date Frederick B. Ayer & Associates has contracted a total of 80 surplus piston-engine aircraft from airlines now re-equipping with jets. These include: 30 Convair 240s and 45 Douglas DC-6s from American Airlines; and 3 Convair 440s and 2 Douglas DC-6Bs from Continental Airlines. The Convair 240s are being offered in the 40-passenger airline configuration at $250,000, modified for long-range executive use at $385,000. Convair 440s are being offered to airlines at $550,000, or converted as executives at $650,000. Ayer has first refusal on American's remaining 36 DC-6s.

● **KLM, Royal Dutch Airlines,** has increased the frequency of non-stop New York–Curaçao flights from four to six round trips per week, adding Aruba as a stop on two of the flights, in order to meet an increase in Caribbean traffic out of New York. This has forced KLM to cut down on some of the island-hopping flights operated between Miami and Curaçao; Port-au-Prince and Ciudad Trujillo have been cut out, and the frequency of services between Miami and Havana/Kingston, Jamaica/Haiti, Dominican Republic and Curaçao has been reduced from seven to four per week.

● **The Greek Ministry of Communications** has authorized the following companies to operate tourist services over the period March–October: Arkia, Israel Inland Airlines Ltd., will operate a once weekly tourist service from Israel to Rhodes and return, from mid-April to early October. Air Hire Ltd., of London, has been given permission to operate similar flights every nine days from May 23rd to September 13th. Deutsche Flugdienst GmbH has been authorized to operate 17 special flights Frankfurt–Athens, 17 Hamburg–Athens and 16 Düsseldorf–Athens, over the period mid-March to end of October.

● **Sudan Airways** will inaugurate scheduled services London–Rome–Athens–Cairo–Khartoum on June 8th. The services will be operated with Airwork *Viscount 831s.* Initial frequency will be once weekly departing Gatwick each Monday, and arriving Khartoum on Tuesdays; flight time approximately 17 hours. The aircraft will then operate two scheduled flights Khartoum–Cairo before leaving Khartoum on Thursdays for London. Sudan Airways has secured traffic rights at all intermediate points.

● **Japan Air Lines'** three times weekly DC-7C flights direct Tokyo–Los Angeles commenced on May 29th. JAL was already operating four Tokyo–San Francisco flights weekly, and in July will inaugurate two flights weekly from Seattle. Los Angeles–Tokyo flying time will be 23 hours with an additional two-hour stop at Honolulu and 45 minutes for refuelling at Wake Island; this will be cut to 12 hours 45 minutes in 1960 when JAL introduces the four Douglas DC-8s now on order (first delivery expected in July 1960). JAL



The projected Lockheed Super Hercules *strategic turboprop transport, powered by four Allison T61s (model 550-B1); take-off weight approx. 204,170 lb. The* Super Hercules, *an improved version of the C-130* Hercules, *is offered in both military and civil versions.*

Christening at Sud Aviation. Left: *Madame Charles de Gaulle, wife of the French President, bestows the name "Lorraine" on one of Air France's* Caravelles. *Georges Héreil, Sud Aviation President, is seen presenting to her the two test pilots, Pierre Nadot and G. Galy. With his back to the camera is Robert Buron, Minister of Public Works and Commercial Aviation. Right: a Scandinavian Airlines System* Caravelle *was christened "Finn Viking" by the wife of Åke Rusck, SAS President.*

Captain George A. Edwards, USAF, has set up a new world speed record of 816.279 m.p.h. (1,307 km/h) on a 500-km closed circuit, in a McDonnell RF-101 Voodoo.

The Northrop T-38 Talon *twin-jet supersonic trainer made its maiden flight on April 10th, 1959. Take-off weight for the first flight was approx. 5 tons. The trainer is powered by two General Electric J85 jet engines.*

will employ American captains to operate the Los Angeles–Tokyo route under a lease arrangement with United Air Lines; the remainder of the flight crew will be Japanese. JAL plans to build Los Angeles terminal facilities but will share facilities with SAS until that time.

INDUSTRIAL

● **The National Aeronautics and Space Administration** is asking Congress for $14,000,000 to construct a Space Center to house NASA space sciences activities, and facilities for processing data from space vehicles. The center would be built at Beltsville, Maryland, a suburb of Washington, D.C. The plan for the space center is part of the $485,000,000 NASA budget for the 1960 fiscal year beginning July 1st. NASA also reports that all major contracts for the economy *Scout* satellite launching vehicle have now been awarded. The *Scout*, which will cost a modest $500,000, will be employed to place a 159-lb. satellite in a 300-mile high orbit. The last major contract has been awarded to Chance Vought Aircraft, Inc. for airframe and assembly of the four stages. Other contracts already awarded are: Aerojet-General Corporation—first-stage engine; Thiokol Inc.—second-stage engine; Hercules Powder Company—third and fourth-stage engines; Minneapolis-Honeywell Company—gyroscopic guidance and spin stabilization equipment. NASA has appointed Dr. Allen E. Puckett and Dr. Leo Stoolman of the Hughes Aircraft Company's research and development laboratories to two new research advisory committees.

● **Major General Bernard A. Schriever,** Chief of the Air Research and Development Command, has told a Senate sub-committee studying space activities that the Pentagon's Advanced Research Projects Agency (ARPA) should be eliminated because it is slowing down the national space programme. Schriever told Senators that ARPA has become a fourth service, dealing with space, and that the USAF, Army and Navy should be given its tasks and funds (some $450 million has been proposed for the agency in the fiscal 1960 budget). He said that ARPA is complicating matters in the space and missile field and that the first ICBMs which he had pushed through to production would have been delayed by years under ARPA procedures. ARPA was set up early in 1958, shortly after the Soviet Union's first *Sputnik* was placed in orbit) and, according to Schriever, the agency filled a necessary need at that time in focusing public attention on space programme requirements. Now, however, ARPA control of the research phase of weapons has made it impossible to plan, programme or budget on a completely integrated basis; he added that most of ARPA's development programme was in any case initiated by the USAF, "working with peanuts". ARPA, with a total of only 80 persons directly employed, is considered to be merely a management agency.

● **Aeronutronic Systems Inc.,** West Coast subsidiary of the Ford Motor Company, has been awarded the first part of a $23 million contract to develop the *Shillelagh* missile, a new lightweight tactical ground-to-ground weapon for U.S. Army ground troops. The *Shillelagh* is expected by the Army to be operational by the mid-1960s. No description of the new weapon has been released other than that it is a lightweight guided missile system for close-in support of ground troops and can be mounted on vehicles. It is generally believed, however, that the *Shillelagh* will be used to deliver the new and highly secret *Davy Crockett* tactical atomic warhead. Aeronutronic will start the new missile programme at its Maywood, California, plant under direction of Roy P. Jackson, General Manager of the Tactical Weapon Systems Division.

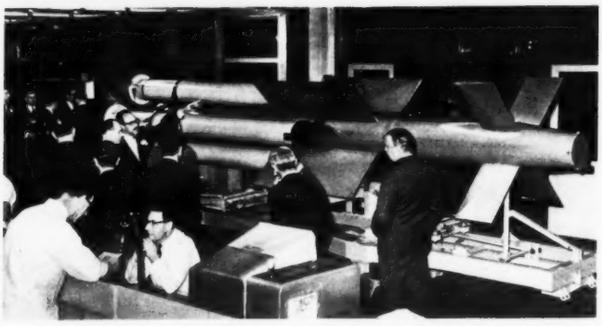
● **Goodrich-High Voltage Astronautics, Inc.** is a new company formed by B. F. Goodrich Company and High Voltage Engineering Corporation, to develop ion engines for space vehicles. Headquarters will be at Burlington, Mass., where HVEC has already undertaken work on the development of a laboratory ion thrust device. This work will be continued by the new firm. Chairman of Goodrich-High Voltage Astronautics is P. W. Perdriau, General Manager of the Goodrich Aviation Products Division, and President is John Gale, Vice President and Director of Applied Research at HVEC.

● **Thompson-Ramo-Wooldridge Products Company,** a division of Thompson-Ramo-Wooldridge Inc., and the French company Intertechnique SARL of Boulogne–Billancourt, have jointly announced a licencing agreement for the manufacture and sale of the RW-300 digital control computer in France. Intertechnique, a subsidiary of Générale Aéronautique Marcel Dassault, is engaged in the fields of aircraft and nuclear instrumentation, aircraft accessories, oxygen equipment, industrial fuel gauges, and digital computers and controls.

AIRCRAFT AND EQUIPMENT

● **Cessna Aircraft Company** has announced its new version CH-1C helicopter which differs from earlier models in having further improved electronic equipment to permit full instrument flight operation. This new 3-to-4-seat helicopter features a maximum gross

Société Française d'Entretien et de Réparation de Matériel Aéronautique (SFERMA), with plant at Bordeaux-Mérignac, is engaged on the maintenance, conversion and modernization of twin-engine Beech communications aircraft; for example, conversion of the UC-45 to D-18S standards. Second picture shows SFERMA's "runway hangar" and gives a good idea of the wide variety of aircraft on which the company works.



Opening of Sperry Gyroscope Company Limited's new Bracknell plant. Top: *general view;* left: *the Minister of Supply, the Right Hon. Aubrey Jones, unveiling the plaque at the main entrance. Next to him is Robert Broadbent, Sperry Managing Director;* right: *inspecting the* Seaslug *ship-to-air guided weapon. Sperry also manufactures the control systems for the* Seaslug *and* Blue Streak.

Model of the RF-1 STOL aircraft under development at Rhein-Flugzeugbau. It is fitted with two 240-h.p. Lycoming engines which jointly drive a ducted four-blade pusher propeller. The first flight of the RF-1 will be made before the end of 1959.

Austria's M. 222 touring aircraft manufactured by Simmering-Graz-Pauker. The 4-to-5-seat aircraft is powered by two 140-h.p. Lycoming O-290 D engines.

The Cessna 210 four-seat touring aircraft, with a 260-h.p. Continental engine.

weight of 3,100 lb. and an empty weight of 2,050 lb. It is powered by a 270-h.p. Continental engine. CH-1C has a cruising speed of 80 to 105 knots; rate of climb at sea level, with maximum gross weight, is 950 f.p.m.; maximum cruising endurance 5.15 hours.

● **Curtiss-Wright Corporation** has unveiled a new small turbine engine called the *Turbo-Mite*. Developed and built by the firm's Santa Barbara, California, Division, the turbine is 13½ in. long, 10 in. in diameter and weighs only 30 lb. It is specially adaptable to drive airborne electrical power sources. *Turbo-Mite* is of twin-spool layout.

● **The firm of Glasflügel, Ingenieur Eugen Hänle,** of Schlattstall, Kreis Nürtingen/Württemberg, is developing and manufacturing helicopter rotor blades of fibreglass-reinforced plastics. In this design the whole of the forces are taken up by the plastics, and no other stiffening members are incorporated. Rotors can be manufactured in a wide variety of versions, with different weights, centres of gravity and flexing qualities. Thanks to relatively low tooling costs, production of even small quantities is said to be economic.

● **The second Vickers Vanguard** airliner made its first flight on April 22nd, 1959, from Weybridge.

● **The Twin Pioneer Series 3** has now superseded the Series 2 on the Scottish Aviation production line. The Series 3 is powered by two Alvis *Leonides 531/8* engines of 625 h.p. each. Payload and performance have been increased with the higher rated engines. The 16-passenger version has a take-off weight of 14,600 lb. and a range of 656 miles with full fuel and normal allowances. At full all-up weight (sea level, still air) the Series 3 requires a ground run to unstick of 140 yards and a landing run of 204 yards. Six main versions are offered: passenger transport; freighter; ambulance; photographic version with an F24 camera; photographic version with RC5a and RC7a cameras; executive transport. The Philippine Air Lines *Twin Pioneers* are powered by Pratt & Whitney R-1340 engines, and one of the five ordered will be on show at the Paris Salon.

● **Latest Bristol Olympus variant** to be announced is the Mark 146 which also bears the experimental designation BOl.21. No rating announced. Latest de Havilland *Gyron Junior* is designated DGJ.20.

● **The new Vertol YHC-1B Chinook helicopter** can carry a payload of more than 3 tons on what is described as a "normal mission", with a radius of action of 100 nautical miles. Cruising speed in this case is 125+ knots at 5,000 ft.; service ceiling with one engine cut is more than 7,000 ft.; maximum rate of climb at sea level more than 2,500 f.p.m. If required the YHC-1B can carry up to 6½ tons for a radius of action of 100 nautical miles. Under these operating conditions, hovering ceiling (with ground effect) is still 2,000 ft.; cruising speed is given as approximately 120 knots; maximum sea level rate of climb more than 1,500 f.p.m.; maximum range (without payload, for ferry flights) approximately 1,100 nautical miles.

● **Frankfurt's Rhein-Main Airport** has just taken into service its first sweeper vehicle designed to clean runways, taxiways and aprons. The model used is a Schörling design mounted on a Henschel Type HS 100 chassis with separate 6 R 1115 propulsion system. The vehicle works on the vacuum principle; a Perlon brush system rotating in the direction opposite to that of travel sweeps all foreign bodies into a powerful air stream, which carries them into a large container under vacuum. The air stream is produced by a fan driven by a 125-h.p. Henschel engine. Sweeping speed is up to 25 m.p.h., depending on amount of dirt, and swath is 7.4 ft. Max. performance per hour is thus roughly 970,000 sq. ft. Permissible maximum speed for road use is 40 m.p.h.

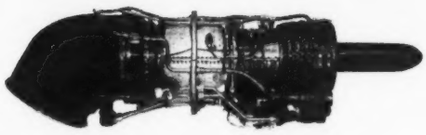
● **Initial production RB.141 by-pass engines** for the DH.121 airliner will probably be rated at 14,300 lb. thrust, and power ratings as high as 16,000 lb. are expected later. Bench running of the 12,000 lb. thrust RB.141 is expected to commence late this year.

● **A development of the Bristol Orpheus** turbojet engine to 8,500—9,000 lb. thrust is anticipated by the end of 1961. It is understood that this will be a ducted fan engine particularly for civil use. The overhaul life of the normal civil *Orpheus* is expected to be up to 1,000 hours in 1962, rising to over 2,400 hours by the end of 1964. The derated *Orpheus BOr.4* for the Folland *Gnat Trainer* is now on test in a *Gnat* fighter at Filton.

● **The Army's Sikorsky H-34** cargo helicopter will be fitted with the RYANAV model 120B doppler automatic navigation system and hovering device. The 120B is under production at Ryan's San Diego Electronics Division.

LIGHT

COMPACT



The GNOME
1000 Shaft Horse Power
Weight 275 lb.
Consumption ·65 lb./s h p/hr.

ADAPTABLE

ECONOMICAL

The de Havilland Engine Company Limited, Leavesden, Hertfordshire, England

Caravelle

is in service on the European network of AIR FRANCE

PARIS-MILAN : 1 hr 20 min flight
PARIS-ROME : 2 hr flight
PARIS-ATHENS : 3 hr 50 min flight
PARIS-ISTANBUL : 5 hr flight

TOTAL SILENCE AT 500 MPH

AIR FRANCE

THE WORLD'S LONGEST ROUTE NETWORK

A FLEET OF 24 CARAVELLES WILL BE PROGRESSIVELY INTRODUCED ON THE WHOLE OF AIR FRANCE'S EUROPEAN NETWORK
CONSULT YOUR TRAVEL BUREAU OR THE NEAREST AIR FRANCE AGENCY. RESERVE YOUR SEAT IN TIME—TODAY

THE NEW BELL 204

WORLD'S MOST PROVEN

TURBINE-POWERED HELICOPTER

Bell's famous 47 model series helicopters are in military and civilian use throughout the world with over 2½ million hours of flight experience. From this experience comes Bell's brilliant new turbine-powered 204.

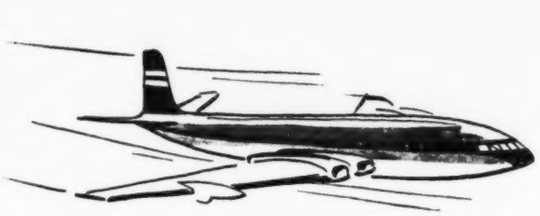
The 204's military counterpart, the Bell H-40, was designed to meet the most exacting standards of performance and maintenance . . the most thorough testing ever required by U. S. military specification. The 204 is low in silhouette, with extreme maneuverability and high speed. It seats eight passengers and can be quickly converted into a 12-passenger troop carrier, or can be equipped with 2,000 pounds of rocket and machine gun armament. The 204 is also capable of carrying 4 litter patients and attendant.

Any component, including complete engine, can be replaced within 40 minutes' time, without special tools and all are designed for a minimum of 1,000 hours operation between overhauls. The Bell 204 is so reliable, maintenance-wise, that a fleet of seven would be equivalent to 12 competitive helicopters of equal flying performance. The Bell 204 will be on display at the Paris Air Show in June . . it will be available for export in one year. For complete information, write Dept. 17F, Bell Helicopter Corporation, Fort Worth, Texas, U.S.A.

BELL
HELICOPTER CORP.

FORT WORTH, TEXAS • SUBSIDIARY OF BELL AIRCRAFT CORPORATION

Baudouin



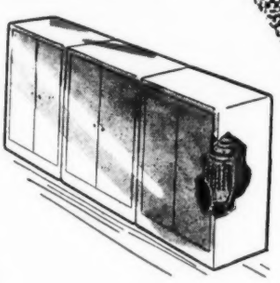
Preparing air traffic control for the Jet age:

Automatic flight progress display

SATCO

Automatic Air Traffic Control System

SATCO increases the handling capacity of air traffic control centres without any sacrifice of safety and without requiring any major change in present flying procedures or air traffic organisation.



Computer and memory drum - calculations and conflict search

Principal features of SATCO:

Automatic coordination between control positions
Automatic flight data display systems
Extensive facilities for civil/military coordination
Special calculations for turbine aircraft
Special pre-departure facilities for air line operators
Uses latest type digital computers, fully transistorised
Fail-safe and self-checking.

Flight planning

SIGNAAL

N. V. HOLLANDSE SIGNAALAPPARATEN HENGELO · NETHERLANDS

New Concept
In Power Conversion For Jet Aircraft
MAIN ENGINE STARTING AND CONSTANT SPEED
ELECTRICAL POWER IN A SINGLE PACKAGE

THE AIRESEARCH CONSTANT SPEED DRIVE STARTER

is a combined constant speed generator drive and pneumatic starter which will provide turbine-powered aircraft with main engine starting and full electrical power both on the ground and in flight.

Advantages are :

1. Combines in *one* lightweight unit pneumatic starting and electrical power. Utilizes starter turbine (which is normally considered as in-flight "dead-weight") for constant speed trim.

2. Provides full electrical power on ground without operating main engines by using a source of compressed air.

3. Provides full electrical power in flight with a minimum use of bleed air for speed correction. Full electrical power can be maintained on a non-operating engine by cross-bleeding air from operating engine.

4. The unit can be made self-contained on the ground or in the air by installing an AiResearch gas turbine into the aircraft. This closed system will fulfil the three conditions listed above.

Other features : Extremely light weight . . . low oil heat rejection . . . self-contained, self-cooling lubricating system . . . high temperature operation . . . constant speed output pad available for additional accessories . . . sizes from 20 KVA to 90 KVA.

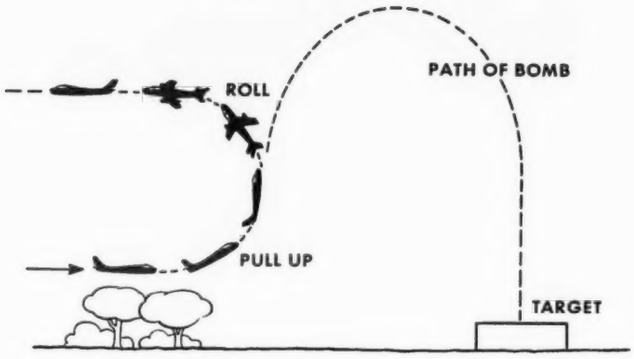
A high degree of dependability has been achieved by using a turbine, gear train and control system similar to that employed in production air turbine starters and air turbine motors built by AiResearch which have accumulated thousands of hours of successful operation. For further information, write to The Garrett Corporation, 26 Rue de la Confédération, Geneva, Switzerland.

THE GARRETT CORPORATION

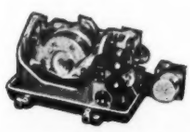
AiResearch Manufacturing Divisions

Los Angeles 45, California • Phœnix, Arizona, U.S.A.

Systems, Packages and Components for : AIRCRAFT, MISSILE, ELECTRONIC, NUCLEAR AND INDUSTRIAL APPLICATIONS



This diagram shows how a Honeywell low altitude bombing system (LABS) takes over for the pilot, pulls a low-flying plane into a steep climb, literally tosses the bomb, then rolls the plane upright. It enables pilots to fly low, avoiding enemy radar, deliver a nuclear bomb and escape before the explosion. This complex system being supplied to the U. S. Armed Forces is another example of advanced engineering from Honeywell—one of America's most exciting companies.



Cageable Vertical Gyro JG7044

Heart of the LABS system is Honeywell's Cageable Vertical Gyro JG7044. It has many applications as a vertical reference in radar stabilization, fire control, bombing, navigation and flight control systems. Has the fastest caging action available today.

Honeywell

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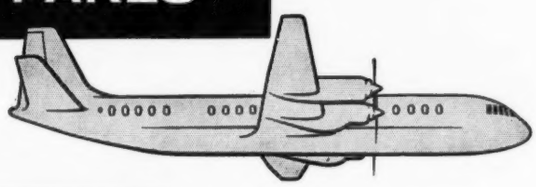
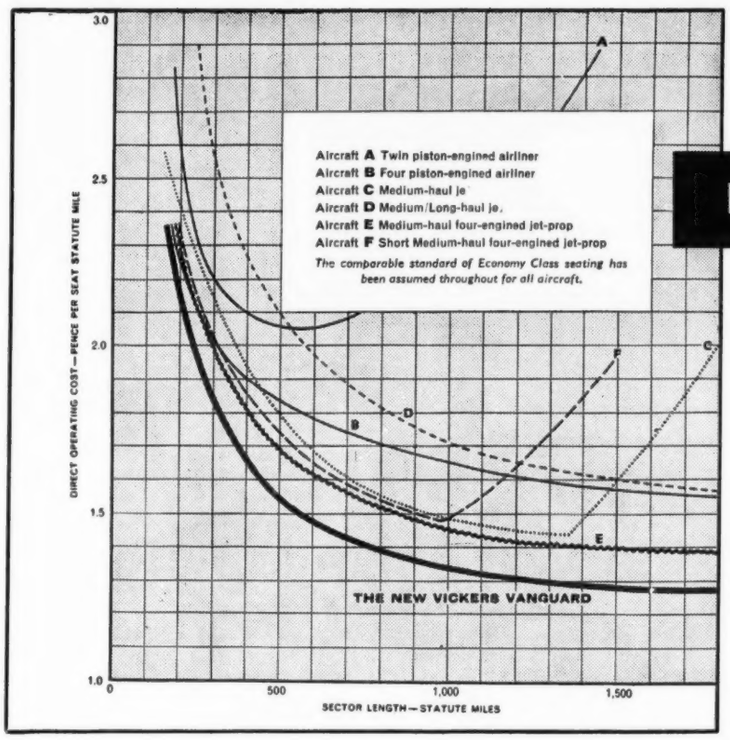
LOWER FARES





yet

MORE PROFIT

The attraction of cheap rate tickets has already been proved on long distance routes. On North Atlantic flights 60% of all passengers now travel at economy fares. A similar cut in fares would be equally popular on short and medium-haul routes, and be the means of boosting traffic considerably. The only aircraft capable of bringing about these reductions, *and* making a profit, is the Vickers Vanguard.
In its economy class layout, the Vanguard has over 50% greater profit potential than any competitive air liner. By a substantial margin its seat-mile costs are the lowest on offer today.

What fare cuts are possible?

At 65% passenger load factor the new Vanguard, in its 139-seater economy layout, can operate at 10% clear net profit with fares ranging from 29-50% below current tourist rates. In calculating these figures actual routes, current fares and current costs have been used.

Only the VANGUARD has all these features

425 m.p.h. cruising · Seat-mile cost as low as one cent per seat-mile · Freight capacity 10 tons at normal densities · Full routing and A.T.C. flexibility · Can use normal existing airfields · Quick turn-round · No airfield noise problems · Quiet, smooth flight · Ten years' unique Vickers/Rolls-Royce jet-prop experience.

PROFIT with the NEW

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE JET-PROP ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY ENGLAND

THE C 450 "COLEOPTER"

With its revolutionary design, this experimental aircraft, for **vertical take-off and landing,** opens up new prospects for aviation in the following fields :

propulsion,
mechanics of flight,
operational efficiency.

With its ability to operate without runways or costly ground handling equipment, the **C-450 COLEOPTER,** whose technology can be used on remote-controlled aircraft or missiles of all kinds as well as on piloted aircraft, constitutes a vital step forwards in the history of aviation.

SOCIÉTÉ NATIONALE
D'ÉTUDE ET DE CONSTRUCTION
DE MOTEURS D'AVIATION

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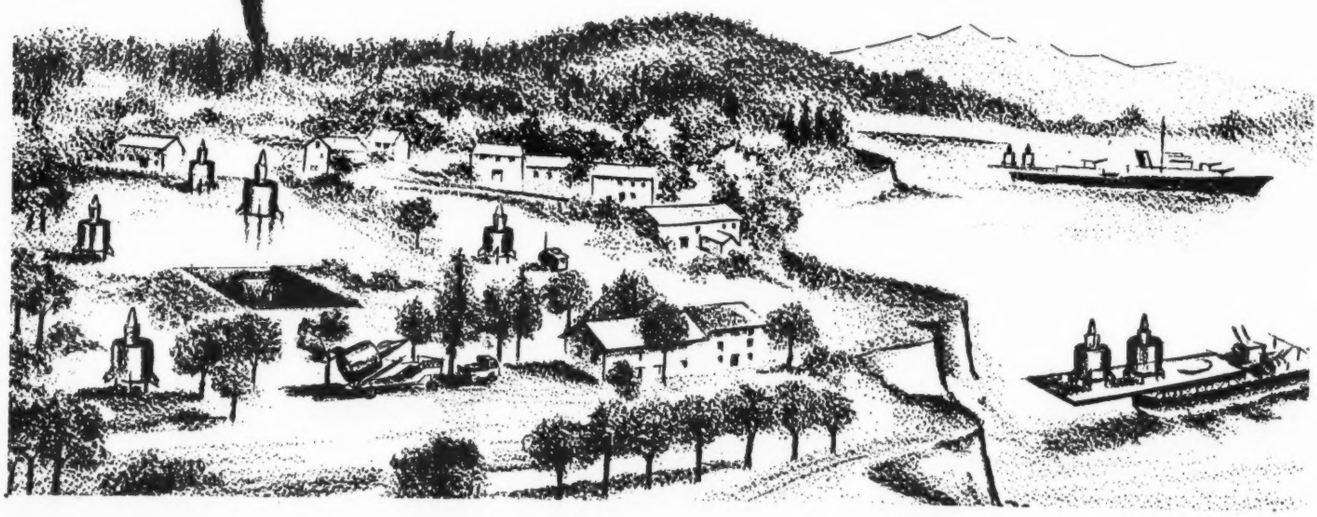

Quadradar provides rapid accurate altitude of all aircraft in terminal area!

Provides greater safety through rapid coverage of all runways from one location

Gilfillan Quadradar provides rapid, accurate altitude, azimuth and range information on any aircraft, up to 50,000 feet. Quadradar provides further safety with rapid coverage of all runways from one location.

With Quadradar, pilots are informed of other aircraft in the terminal area, reducing collision hazards. Aircraft are landed from either direction of runways without relocating equipment.

Quadradar provides terminal area surveillance, final approach, height-finding and airfield surface information. It is compatible with present systems to make for greater safety in final approach, air traffic control and high-performance climb-outs.

SEVEN GILFILLAN PLANTS IN SOUTHERN CALIFORNIA / HEADQUARTERS: 1815 VENICE BOULEVARD, LOS ANGELES, CALIFORNIA

GILFILLAN QUADRADAR IS NOW IN OPERATION BY THE U.S. ARMY, USAF, U.S. NAVY, U.S. MARINE CORPS, ROYAL CANADIAN AF, ROYAL DANISH AF, FRENCH AF, ARGENTINE NAVY, GERMAN AF, ITALIAN AF, FINNISH AF, YUGOSLAV AF, ISRAELI AF, IRISH CAA, ROYAL AUSTRALIAN AF, FRENCH CAA, AUSTRIAN CAA, BOEING AIRPLANE CO., AND NORTHWEST AIRLINES. LOCKHEED, DOUGLAS, CONVAIR, NORTH AMERICAN AND HUGHES AIRCRAFT COMPANIES HAVE A JOINT OPERATION USING QUADRADAR AT PALMDALE FLIGHT TEST CENTER. OTHER INSTALLATIONS INCLUDE MOFFETT NAS, AND AT THE SOUTH POLE.

Quadradar is distributed outside the United States by RCA International Division,
30 Rockefeller Plaza, New York, New York. For details, contact your local RCA Int. distributor.

APACHE World's most widely purchased twin-engine executive transport. In world-wide use with business firms, government agencies, airlines, air charter services and private owners. Powered with two 160 hp Lycoming engines, carries 4 or 5 in quiet, spacious, luxuriously appointed cabin. Cruises over 170 mph (274 kph), range over 1200 miles (1931 km). Exceptional short field, high altitude performance.

PIPER OFFERS A COMPLETE LINE of World-Proven General Purpose Aircraft

SUPER CUB Modern version of the famous Piper Cub, available in two models. 90 hp Super Cub is ideal for flight training, flying clubs. 150 hp Super Cub is unmatched for high altitude mountain flying, patrol, survey, military liaison, farm and ranch. Also PA-18-A Super Cub for dusting and spraying.

COMANCHE World's most advanced single-engine, four-passenger airplane. Available in two versions. 250 horsepower Comanche cruises 181 mph, has maximum range of 1100 miles (1770 km). 180 horsepower Comanche cruises 161 mph. Both powered with superbly reliable Lycoming engines. On routine delivery flights, Comanches have been flown non-stop from the United States to Sicily, Lisbon, and Madrid !

TRI-PACER World's most widely purchased, moderately priced, four-passenger plane. Powered with Lycoming 160 hp engine, cruises 134 mph, has over 500 miles (805 km) range. Ideal for air taxi, flying clubs, private flying. Combines the most features to simplify flying—simplified, inter-connected controls, tricycle Hydrasorb landing gear, steerable nose wheel, single hand brake, famous Piper inherent stability.

SEND FOR DETAILS. For brochures on any of these fine Piper aircraft write Dept. V-1, Piper Aircraft Corp., Lock Haven, Pa.

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EXPORT DISTRIBUTOR
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MORE PEOPLE HAVE BOUGHT PIPERS THAN ANY OTHER PLANE IN THE WORLD

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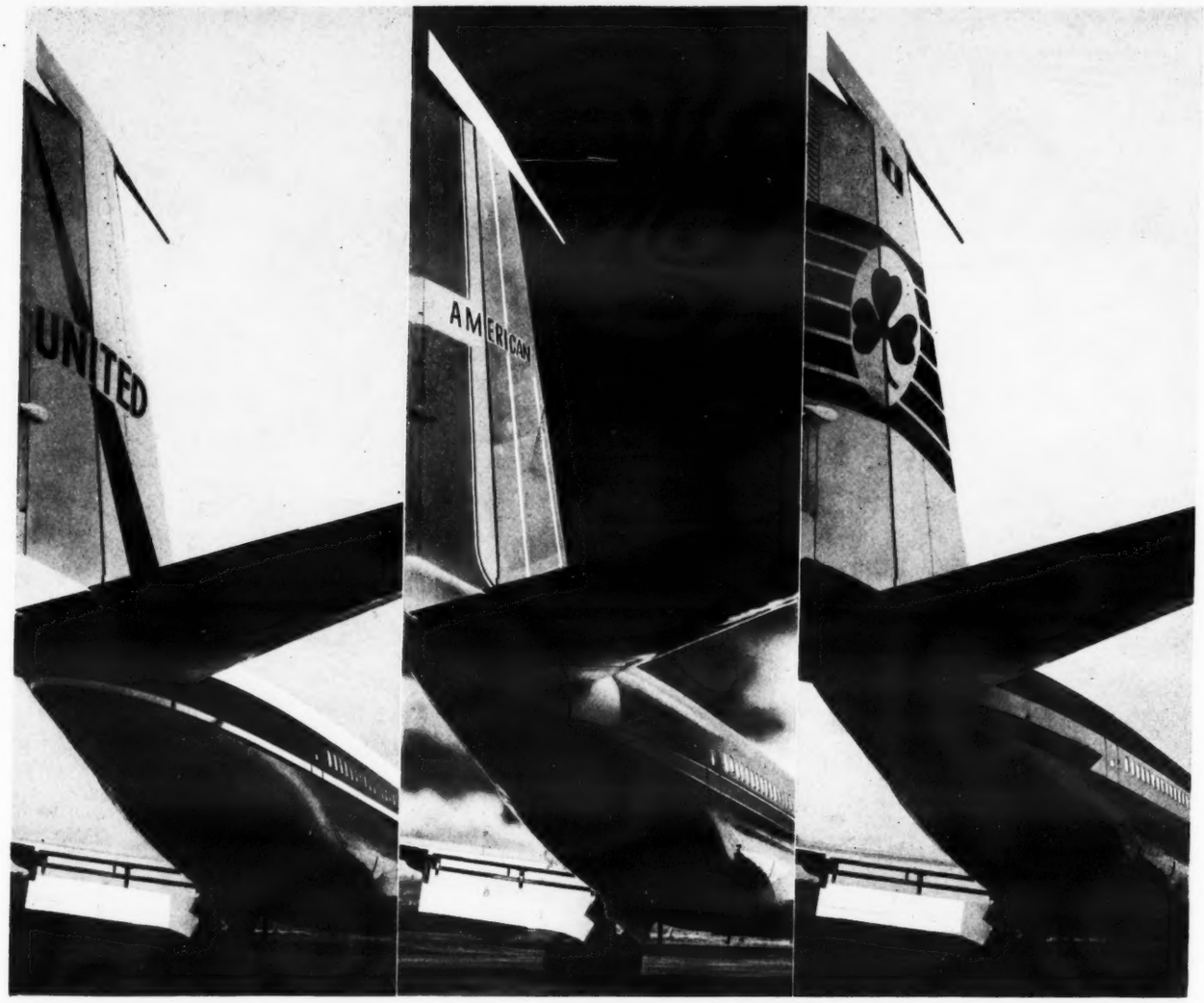

European and U.S. airlines choose the Boeing 720, fastest jetliner in its class.

Latest airline to order the Boeing 720 is Aer Lingus-Irish Air Lines. This purchase, the first by a European operator, brings the total of 720s on order to 39. Earlier purchases were made by American Airlines and United Air Lines for operation over U.S. routes.

The swift, luxurious 720 has a maximum cruise speed of 615 miles an hour. It is specifically designed to operate efficiently and profitably over short-to-medium range routes.

The versatile 720 will bring airlines the advantages of tremendous earnings, extremely high initial utilization, and unprecedented passenger appeal — as demonstrated by the brilliant success of Boeing jets already in service.

Other members of the Boeing jetliner family are the 707, designed for medium-long range routes, and the 707 Intercontinental, for very long range routes. The Boeing family thus includes a model to meet every airline route requirement.

In all, seventeen airlines have ordered a total of 190 Boeing jetliners. This backlog of orders, the largest in the industry, is a reflection of the confidence airlines have in jetliners built by Boeing, the world's most experienced builder of multi-engine jet aircraft.

These airlines have ordered Boeing 707s or shorter-range 720s:

AIR FRANCE · AIR INDIA
AMERICAN · B.O.A.C. · BRANIFF
CONTINENTAL · CUBANA
IRISH · LUFTHANSA
PAN AMERICAN
QANTAS · SABENA
SOUTH AFRICAN · TWA
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BOEING 720

LABORATOIRE des **LBp** BASSES PRESSIONS

For all VACUUM techniques

Hélitest

MASS SPECTROMETER

LEAK DETECTOR

detects micro leaks of dimensions less than 1/100 of a micron

APPLICATIONS :

Vacuum industry - X-Ray tubes - Transistors - Battery cells - Uranium Hexafluoride circuits - Oil filled heaters (Dow-Therm) - Antibiotic apparatus - Industrial nuclear valves - Hermetic seals - Vacuum fusion - Metallisations.

ANOTHER **L.B.P.** *PRODUCT*

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OIL DISTRIBUTION PUMPS

- Robust
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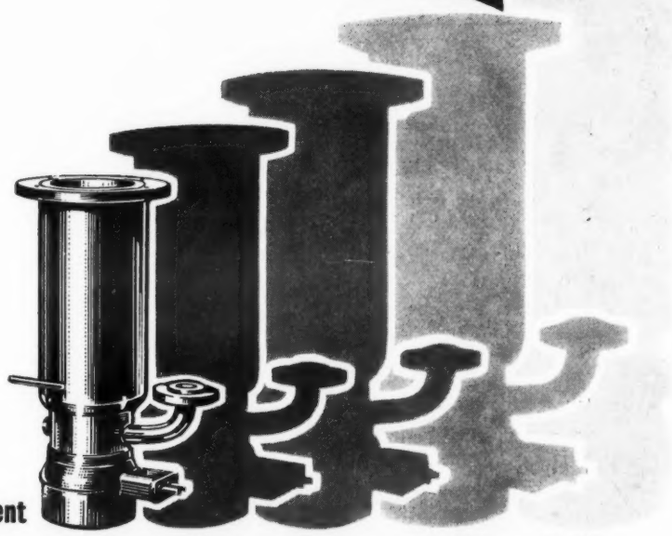
OTHER PRODUCTS
Pipelines
Vanes
Baffle vanes
Stainless steel bellow valves
Pump assemblies

Easily removable armoured heater element



DI 100 DI 250 DI 500 DI 1000 DI 2000

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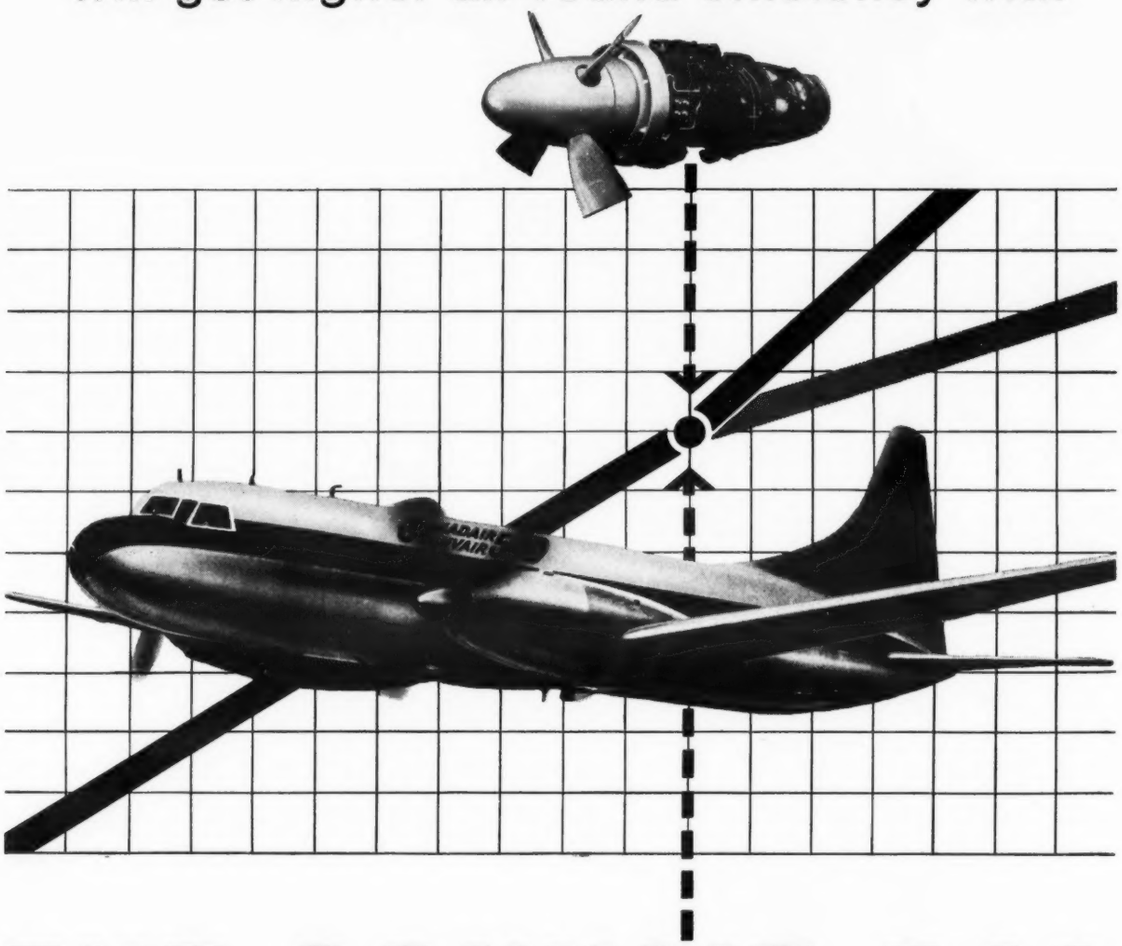
OPERATORS

will get higher all-round efficiency with



THE CONVAIR 540

Convair 340/440's can now be converted to use Napier Eland engines in a fatigue-free airframe originally designed for jet-props.

The Convair 540 is the conversion equivalent of the Canadair 540 now in military and civil production.

Lower costs · Improved performance · Better passenger appeal

Cheaper and simpler maintenance · Extended service life

THE ELAND HAS
- High aerodynamic efficiency
- Low specific weight
- Low specific fuel consumption
- Single lever control
- Automatic temperature compensation

NAPIER ELAND JET-PROP

D. NAPIER & SON LIMITED, LONDON, W.3. A member of the English Electric Aviation Group

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OGA

40 years IN THE SERVICE OF AVIATION

OFFICE GENERAL DE L'AIR

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THE OLDEST ESTABLISHED FIRM IN THE WORLD
FOR THE EXPORT OF AVIATION EQUIPMENT

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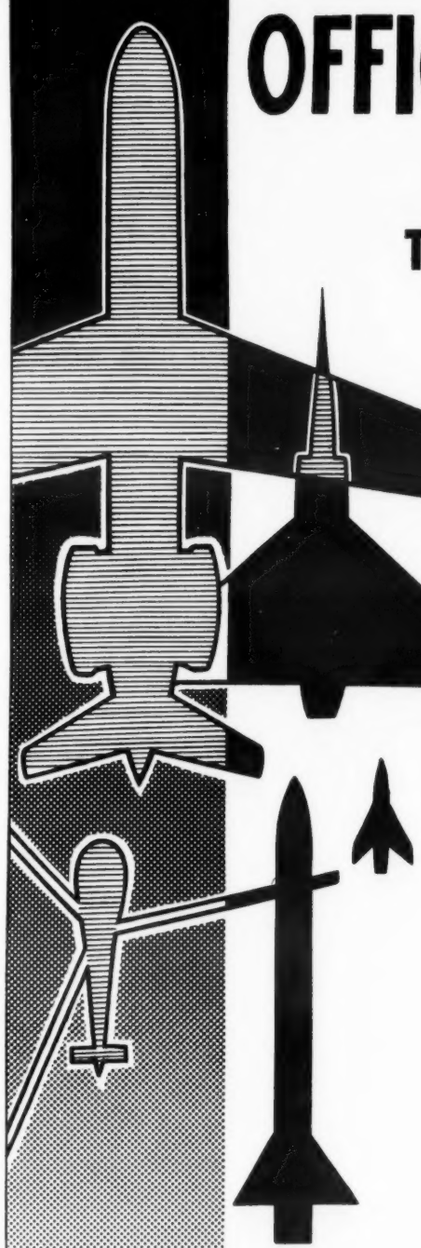

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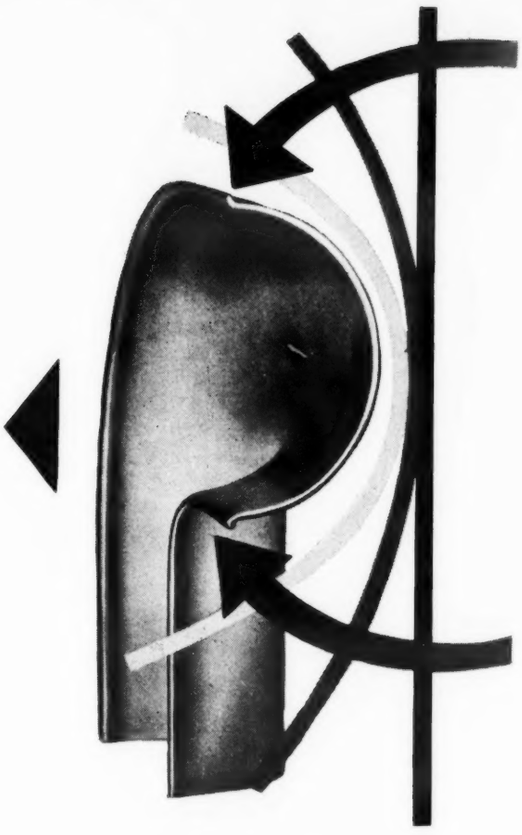
A new way with Pipes, elbows,



The illustration is shown by courtesy of Rolls-Royce Limited

ducts and valves

Wilmot Breeden, interested in the manipulation of metal in the cold state, have developed, in co-operation with famous jet engine firms, manufacturing methods for systems handling fluids at high and low temperatures.

Pipes, elbows, ducts, valves and bearing housings are formed in nickel-chrome alloys in a succession of press operations from a flat blank. Other processes are rolling, spinning, welding, precision machining and high temperature brazing in atmosphere-controlled furnaces. The method allows for a high degree of accuracy and thus minimises leakage problems. Complex and varied formations can be quickly produced. Pipe bend radii can be kept small in relation to diameters without appreciable variation in wall thickness or change of section. Strict quality control is maintained by our radiological and metallurgical laboratories.

The illustration shows a typical component which forms part of the external anti-icing ducting of the Rolls-Royce Conway engine. This system has metal spherical sealing faces and transmits air at elevated temperatures and pressures with a minimum of leakage.

If you have an application for this new method we should be pleased to investigate and advise.

Wilmot Breeden are skilled in metal manipulation *Wilmot Breeden Ltd., Birmingham 1, England*

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presents its range of

VARIO-ALTERNATORS

(constant speed drive)

alternators with automatic control
for constant frequency

4, 6, 12, 15 KVA

Will withstand high ambient temperatures

Self-contained mounting without radiator or hydraulic pipelines

Wide range of driving gear ratios

The lightest in their field

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The RW-300

is the first digital computer for test control and data reduction

MISSILE CHECK-OUT

TEST STAND OPERATION

WIND TUNNEL
INSTRUMENTATION

TELEMETRY
DATA REDUCTION

Now—at the test site—completely automatic test control and data reduction can be handled by a single system incorporating the RW-300 Digital Control Computer manufactured in Europe under license of Thompson-Ramo-Wooldridge Products Company. The new RW-300 can schedule and closely control test routines and it can collect, analyze, and record test data.

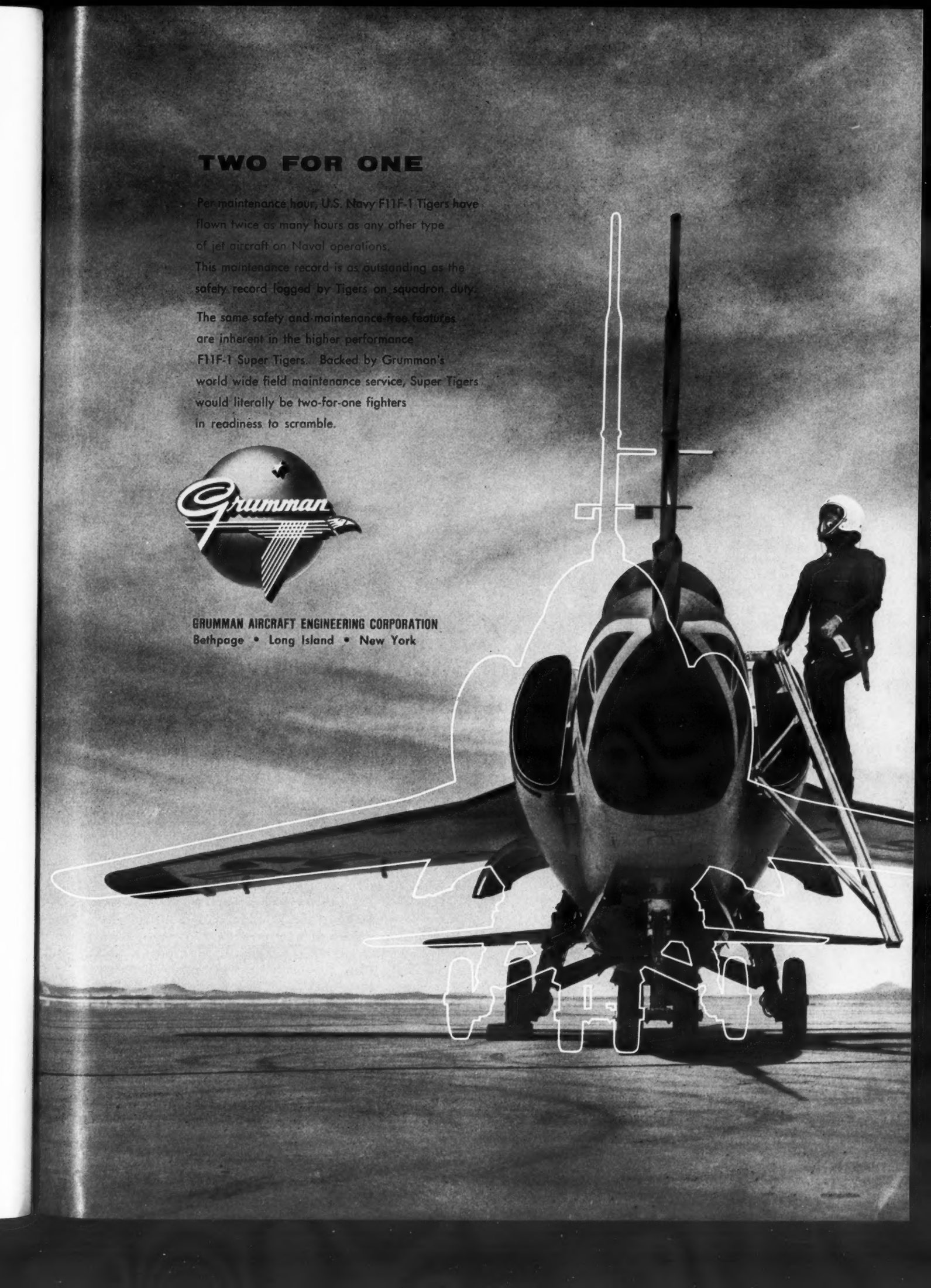
The versatile RW-300 utilizes input data as feedback to modify control actions, thus substantially shortening many test routines. In addition, the RW-300 directly logs both instrument data and complex relationships among these data. Thus test results are available immediately. The time-consuming task of processing raw data through a separate computer, often remote from the test facility, usually can be eliminated.

For technical information on automatic test control and data reduction with the RW-300 and with special digital systems which utilize solid-state components exclusively, write: Digital Controls Division INTERTECHNIQUE—94, Avenue de Paris—VERSAILLES (Seine-et-Oise), France; or call VERsailles 55-62.

Other Products:

Analog-to-digital converters
Data Logging equipment
Transistorized power supplies

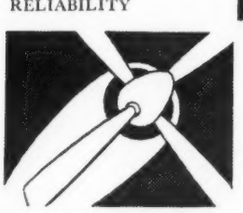
INTERTECHNIQUE

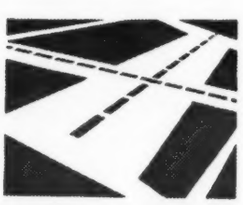

TWO FOR ONE
Per maintenance hour, U.S. Navy F11F-1 Tigers have flown twice as many hours as any other type of jet aircraft on Naval operations.
This maintenance record is as outstanding as the safety record logged by Tigers on squadron duty.
The same safety and maintenance-free features are inherent in the higher performance F11F-1 Super Tigers. Backed by Grumman's world wide field maintenance service, Super Tigers would literally be two-for-one fighters in readiness to scramble.
Grumman
GRUMMAN AIRCRAFT ENGINEERING CORPORATION
Bethpage • Long Island • New York

The Truly Economic Short-Haul Aircraft

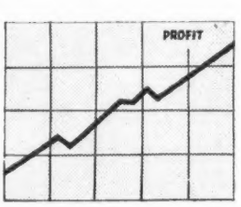
AVRO 748 FLIES EARLY NEXT YEAR

ROLLS-ROYCE
TURBO-PROP
RELIABILITY





USE OF EXISTING
SHORT AIRFIELDS



LOW OPERATING COSTS

Here is an aircraft which offers genuine economy to operators on short-to-medium range routes.
The Avro 748 combines a simple " fail-safe " structure, low wing for added safety and pressurised accommodation for passengers and crew with existing well proven components. It is ideally suited for operation from short airfields and can also operate from semi-prepared surfaces if required.
At low initial cost this aircraft offers maximum economy and servicing simplicity with all the advantages of Rolls-Royce propeller turbine power plant. The Avro 748 will fly early next year and will be in service in 1961. It represents yet another major step by Hawker Siddeley Aviation towards bringing the cost of air transportation down to a minimum level.

HAWKER SIDDELEY AVIATION LTD., Richmond Road, Kingston-upon-Thames.
INTERNATIONAL SALES OFFICE, DUKE'S COURT, ST. JAMES'S, LONDON, S.W.1.

The ANADAC System of Navigation Instruments

A Fresh Approach to Cockpit Instrumentation

In view of the recent tendency to equip aircraft with an increasing number of navigational instruments, it is problematical whether a point of diminishing return has not been reached in the volume of information which can be assimilated by a pilot. This problem is especially acute in a single-seat aircraft.

As a result of several years' experience in the design and manufacture of the R-Theta Navigation Computer System, *Canadian Applied Research Limited* CARL now introduces the ANADAC Automatic Navigation Display & Computation series of Navigation Instruments for use in a low-level light fighter of a type currently being considered for adoption by a number of Air Forces.

The philosophy underlying the design is extremely simple. In the first place, a pilot can only utilize navigational information from a single source at any time, irrespective of the number of aids with which the aircraft is equipped. Secondly, navigation information should be presented to the pilot in a form that is instinctive, in that it consists of steering instructions and requires a minimum of interpretation. Since navigation systems are generally self-contained and have their own method of presentation, there will be several different instruments and modes of display which may be a source of confusion to the pilot.

In the ANADAC system, however, such complementary navigational aids become part of an integrated system, in which information from any one of these aids is controlled and selected for display on a single panel. An extremely simple set of controls and presentation is thus obtained.

The ANADAC Series of Instruments allows the use of all types of rho-theta and theta-theta navigation systems, whether they are of the dead-reckoning type or ground-based radio aids.

A particular feature of this new series is that dead-reckoning computation of the position of an aircraft proceeds continuously and independently of the particular navigation mode which has been selected for display. The pilot may thus choose the information most appropriate to his tactical requirements at all stages of his mission, without fear of losing his position.

Also included as optional equipments are a Moving Chart Presentation Unit and a TACAN Off-Course Computer, both of which greatly increase the scope and versatility of the ANADAC System. The Moving Chart Unit is considered essential for low level operations by some authorities, while the Off-Course Computer extends TACAN Ground Stations. The ANADAC System is designed to accept Doppler data, and will even continue to function in case of failure of the Doppler aid, by virtue of a unique memory, which is part of the dead-reckoning computer.

The ANADAC System is suitable for installation in a single-seat strike fighter which will be an aircraft of light or medium weight. Such an aircraft will normally be used in support of ground operations. In addition to the strike fighter, there is another type of aircraft being developed in various countries, having a larger radius of operation and intended to penetrate more deeply behind enemy lines, probably at low level.

Although these two types of aircraft have different roles, their requirements for navigation equipment are so similar that they can be met by a common system. Obviously a suitable system must have minimum weight and size, be simple to use and capable of utilizing a variety of external navigational aids according to circumstances. Most important, the pilot must be able to place complete reliance on his equipment. Not only must the instruments have an inherent reliability of a high order, but must also continue to give the pilot basic information should the external radio aids be out of action as a result of enemy action or for tactical reasons.

Instruments

In order to meet the foregoing requirements, the indicating display and controls in the ANADAC System are divorced from the Range and Bearing Computer unit, which can now be installed in a convenient location in the aircraft. Furthermore, unnecessary duplication of instruments is avoided as the indicator is intended to serve as the main navigation display, and consequently a significant economy in panel space is achieved.

Since the new series of instruments fully meets the requirements for *Automatic Navigation Display & Computation*, they are referred to as the ANADAC System. This System comprises the following units:

a – Pilot's Navigation Indicator;

b – Control Panels;

c – Range & Bearing Computer;

d – System Junction Box;

e – Pictorial Display Unit;

f – TACAN Off-Course Computer.

An assembly of Units *a* to *d* constitutes the basic minimum system, which can be extended in scope by adding *e* and *f* as required.

A block diagram of a typical system with Doppler monitoring and optional display of ADF and TACAN facilities, is shown in *Fig. 1*. This System may be conveniently considered under the following heads:

a – Inputs;

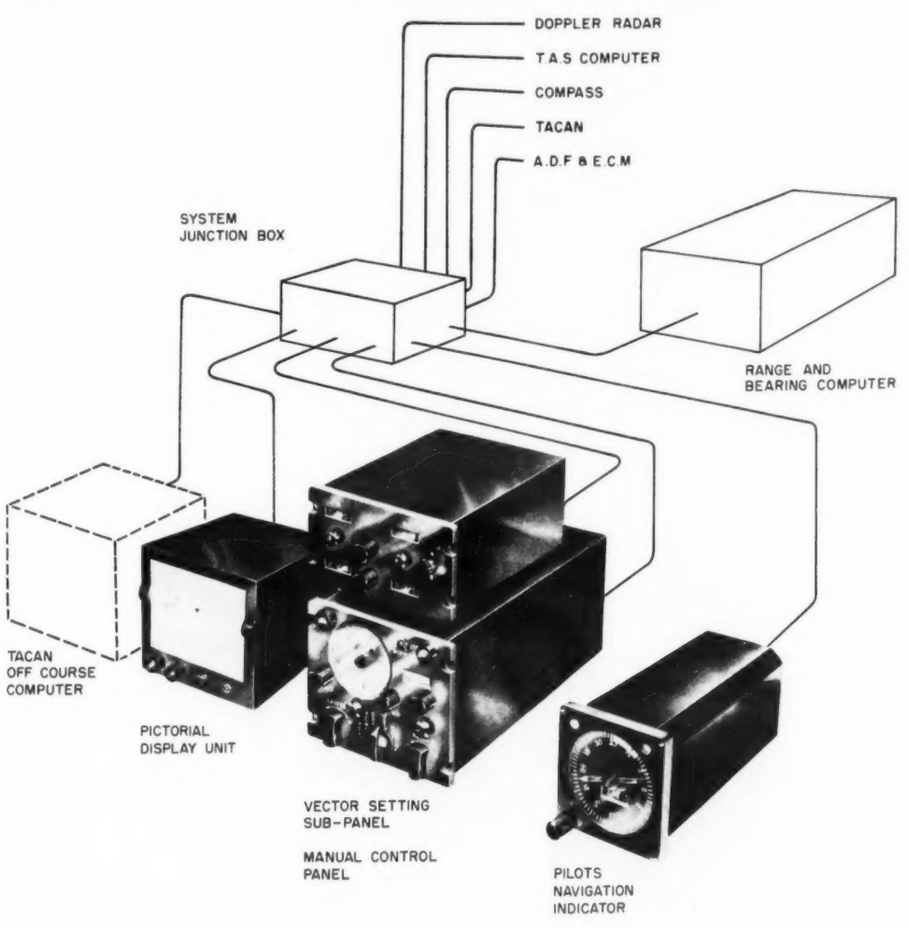
b – Computing elements;

c – Panel display.

Inputs

Inputs to the System fall into two groups. One relates to the dead-reckoning facility, which requires automatic inputs of magnetic heading and true airspeed with ground speed and drift from a Doppler sensor, or alternatively manual inputs of wind speed and direction. The second group comprises bearing information with or without range from navigation aids such as TACAN or ADF.

Fig. 1 :
Schematic diagram of the ANADAC system, showing the five inputs from the Doppler Radar, Wind Speed and Direction, Magnetic Compass, TACAN and ADF.



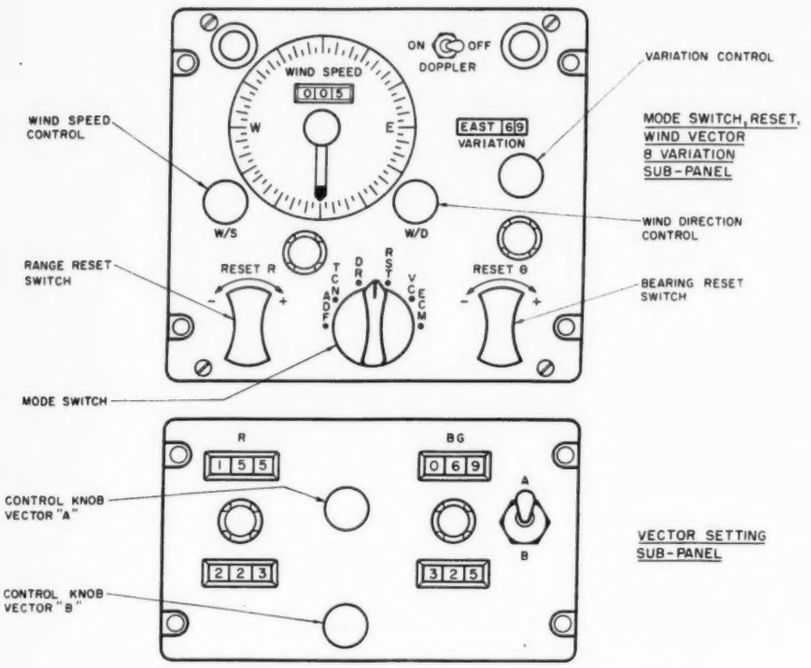
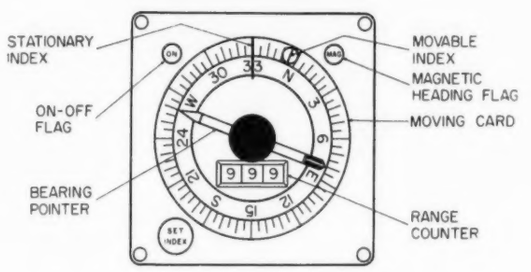


Fig. 2:
Control panel on which is mounted the Function Selector and input controls for the Dead-Reckoning Computer *(left)*.

Fig. 3:
The Pilot's Navigation Indicator, showing the stationary and movable indices, bearing pointer and range counter.



These inputs are all fed into the System Junction Box, and selected by the Mode Switch (or Function Selector) as required for display on the Pilot's Navigation Indicator (PNI), which is intended to serve as the only navigation display. This not only serves as the indicator for the dead-reckoning navigation computer but also for TACAN, VORTAC, ADF, or any other direction-finding equipment, as well as the main compass heading reference.

Computer

The computing elements are essentially similar to those in the well known R-Theta Navigation Computer, and fix the aircraft's position in terms of its distance and bearing from a reference point, which may be either the take-off point or the destination according to the pilot's choice.

Provision has also been made to change the reference point during flight, if required. This is an important feature which enhances the versatility of the equipment.

The ANADAC System can be monitored by Doppler radar at all times; this has obvious advantages over the manual insertion of wind data on account of the much greater accuracy obtained. However, it is conceivable that the Doppler information may be interrupted owing to failure of the radar, or because radar "silence" is to be maintained. This will not affect the computation process, which effectively memorizes a wind vector, and continues computation on the basis of the most recent wind information. The aircraft's position, as calculated by the dead-reckoning computer, may also be easily checked or reset in terms of its distance and bearing from some reference point.

Display

The main display consists of the Control Panel (top panel in fig. 2) and the Pilot's Navigation Indicator. The Panel carries the Function Selector (or Mode Switch), Reset Switches, Wind data and Magnetic Variation Controls. There is also another sub-panel on which additional vectors can be set up and selected for insertion in the computer at any time during fight, if it is required to change the reference point.

The Function Selector is a switch with six positions, which in a typical instance, would correspond to TACAN, ADF, D.R. Computer, Reset, Vector Calibrate, ECM. When any of these functions is selected on the Function Selector, the relevant information is displayed on the Navigation Indicator.

It should be noted that the ANADAC may be used with any navigation aid which is capable of being presented in polar coordinates such as VOR, DME, VORTAC, and is not limited to TACAN and ADF as in the example given above.

The Pilot's Navigation Indicator (Fig. 3) is a multi-purpose instrument which presents basic information to the pilot in the form of steering instructions, as well as distance and bearing of preselected reference points. The instrument employs a moving card presentation which normally indicates the aircraft true heading against the stationary index.

The moving card channel is connected directly to the aircraft's main source of heading reference, namely the magnetic compass, free gyro or stabilized platform. Homing manœuvres are carried out by steering the aircraft until the movable index coincides with the stationary index at the top of the instrument. This method of presentation requires a minimum of interpretation on the part of a pilot and has in practice been found the most efficient. The bearing pointer gives the bearing of a selected reference point on the ground, which is normally obtained from a navigation system employing either radio, dead-reckoning or other methods of computation. The choice of navigation system and the reference point is of course made on the Control Panel.

Facilities

The ANADAC System is designed to be compatible with a variety of radio navigation aids provided information from them can be displayed in polar coordinates. The following selection is intended to be representative of what would be required in a typical light fighter, but is not complete.

In the *TACAN position* of the Function Selector, the output from a TACAN transmitter-receiver is fed directly to the PNI. However, the dead-reckoning computation continues in the Range and Bearing computer whilst TACAN information is being displayed and is available for cross-checking purposes where necessary.

In order to extend TACAN coverage to airfields (or targets) other than those equipped with ground TACAN Stations, a *TACAN Off-Course Computer* is available. In this case, TACAN data of aircraft range and bearing are fed to the Off-Course Computer. A vector corresponding to the position of the way-point relative to the TACAN station is also inserted, enabling the Off-Course Computer to solve for the aircraft's position relative to the way-point. This information is displayed on the Indicator.

In the *ADF position* of the Function Selector, signals from the direction-finding receiver are fed to the PNI. At the same time, the rotating card on the PNI is *switched to indicate Magnetic Heading* instead of True Track, while the movable pointer gives the magnetic bearing of the ADF station.

This position is always used whenever Magnetic Heading is required, for example, during landing.

Change of reference point

The dead-reckoning computer at all times gives distance and bearing of the aircraft from a reference point. It often becomes necessary to change this reference point, and special provision has been made for this in the ANADAC System. Two sub-panels, either of which may be used, are available, on which may be set up vectors corresponding to selected alternative reference points. One of these sub-panels stores up to five alternative destinations, which may be selected by push-button. The method of setting up these vectors is extremely simple and can be carried out in flight, thus considerably extending the scope and range of operation of this system.

Pictorial Display Unit

To give the maximum assistance to the pilot in low level tactical operations, the Pictorial Display Unit provides a map presentation showing the aircraft's position by means of a pen on a moving chart. With the aid of this unit, it is a simple matter to locate alternative targets when the pilot finds the primary target to be unavailable.

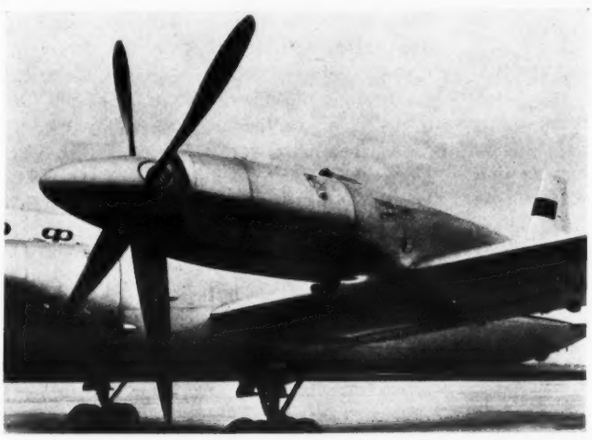
Accuracy

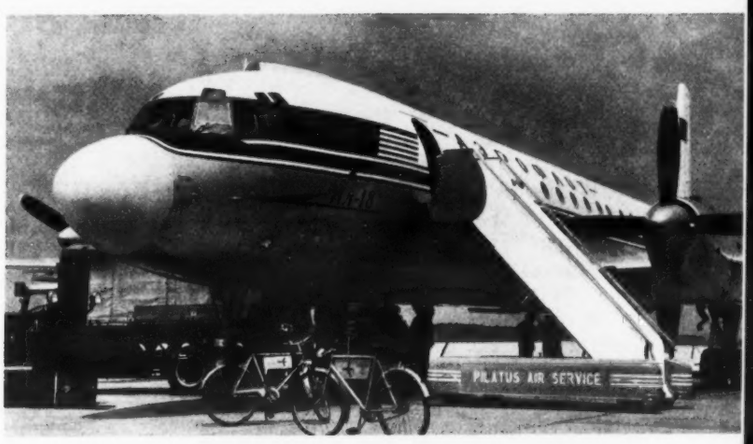
With perfect inputs, the instrumental error of the Dead-Reckoning Computer is probably better than $\pm$ 1½% in terms of the total distance flown. In practice, however, the system performance depends on the accuracy of the inputs.

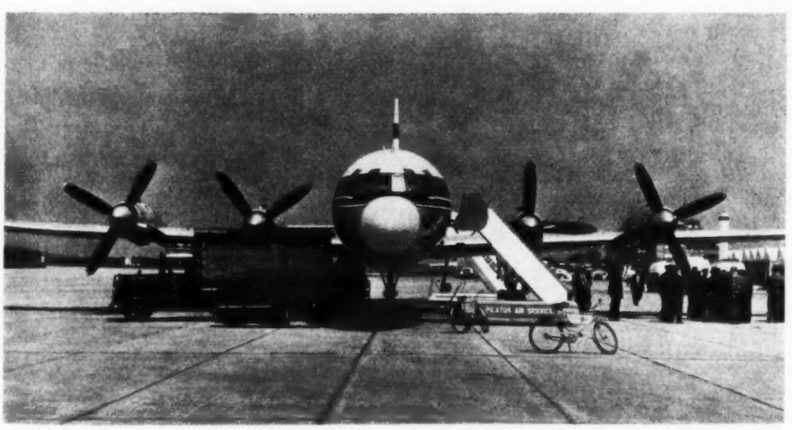
The Moskva in Geneva

The first party of Soviet delegates to the Foreign Ministers' Conference arrived at Cointrin Airport on May 7th in an Ilyushin Il-18 *Moskva* turboprop airliner, which had brought them non-stop from Moscow to Geneva in four hours. *Interavia's* reporter took advantage of the Il-18's two-hour stay for a photographic tour of inspection of the Russian medium-range transport.

The selection of pictures on this page shows details of the aircraft (four Kusnetzov propeller turbines), which was introduced on Aeroflot's domestic network a few weeks ago. Quantity production began some months back. Later production models will be powered by four AI-20 propeller turbines, by the Russian designer Ivchenko, instead of the Kusnetzov NK-4 engines; both engine types have a power of 4,000 h.p.







NASA's New Rocket Booster Programme

In the race for the conquest of space the United States Government has undertaken a long-term programme aimed at developing mammoth rocket vehicles with a launching thrust of more than 2,000 tons to launch space-ships bearing the Stars and Stripes on their journeys to neighbouring planets. Estimated cost of the gigantic programme is more than $2,000 million, for which Congressional approval will have to be obtained. Every single U.S. taxpayer will have to contribute nearly $50 before the *Nova* rocket can lift a several-ton research laboratory to Mars, for example. Trips to the moon and to Venus are also on the list... the adventure tales of our youth have become budget items for the Great Powers.

A few months ago NASA representatives told the U.S. Senate Committee for Aeronautics and Space Science of these far-reaching plans. Eight different rocket vehicles are to be built within the next few years for the multiple tasks of space research. In the order of ascending size and capacity they are as follows:

1. *Scout*, a low-cost four-stage rocket composed of existing solid-propellant motors, which should be ready in about a year's time. The whole vehicle will be roughly 70 ft. long, weigh 35,000 lb. and be capable of lifting satellite payloads of up to 150 lb. in weight into a 300-mile orbit.

2. *Atlas-Able*, an *Atlas* ICBM as first stage, plus second and third stages from the *Vanguard* rocket. Expected to be available soon, this vehicle should be capable of carrying research satellites weighing several hundred pounds.

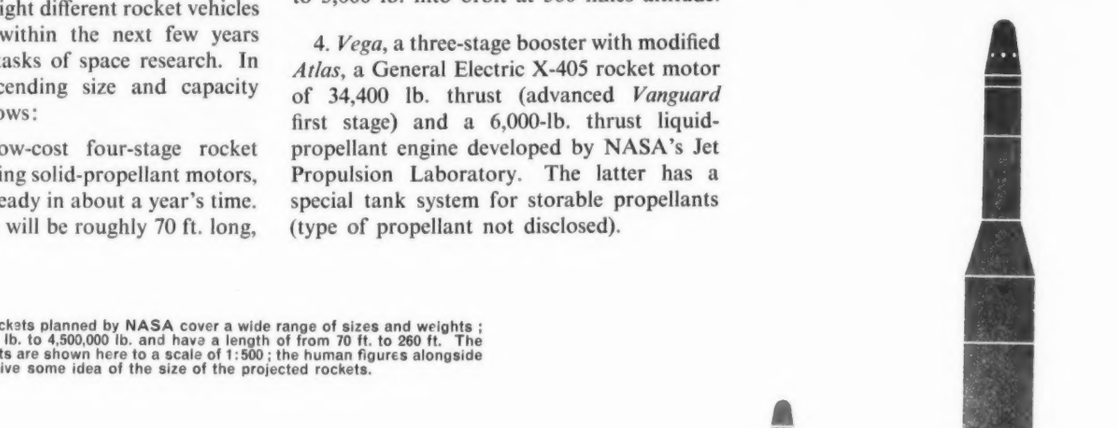
3. *Atlas-Hustler*, a two-stage configuration based on the Convair ICBM and a rocket motor developed by Bell for the B-58 *Hustler's* air-to-surface missile (the Bell/*Hustler* second stage was also used in the launching of ARPA's *Discoverer I* and *Discoverer II* polar satellites from Vandenberg AFB, California). The *Atlas-Hustler* vehicle will be able to raise payloads of up to 3,000 lb. into orbit at 300 miles altitude.

4. *Vega*, a three-stage booster with modified *Atlas*, a General Electric X-405 rocket motor of 34,400 lb. thrust (advanced *Vanguard* first stage) and a 6,000-lb. thrust liquid-propellant engine developed by NASA's Jet Propulsion Laboratory. The latter has a special tank system for storable propellants (type of propellant not disclosed).

5. *Centaur*, similar to *Vega* but with a second stage for liquid hydrogen and liquid oxygen. The Convair Division of General Dynamics Corporation is responsible for development of the whole system, with Pratt & Whitney Division of United Aircraft supplying the second stage motor (two 15,000-lb. thrust parallel units).

6. *Saturn*, a four-stage vehicle based on the giant booster planned for the Army Ballistic Missile Agency. The first stage of this mighty vehicle will deliver a thrust of 1,500,000 lb. It consists of eight clustered Rocketdyne liquid rockets of 187,500 lb. thrust each—an advanced model of the standard engine used in the *Jupiter* IRBM. The second stage will be a modified *Titan* two-barrel engine with a thrust of 300,000 lb.,

The satellite booster rockets planned by NASA cover a wide range of sizes and weights; they weigh from 35,000 lb. to 4,500,000 lb. and have a length of from 70 ft. to 260 ft. The seven new carrier rockets are shown here to a scale of 1:500; the human figures alongside the two outer rockets give some idea of the size of the projected rockets.



and the third stage will comprise the Pratt & Whitney parallel engines (combined thrust 30,000 lb.) for the *Centaur*. The fourth stage finally will be the same Jet Propulsion Laboratory engine as is planned for the *Vega*.

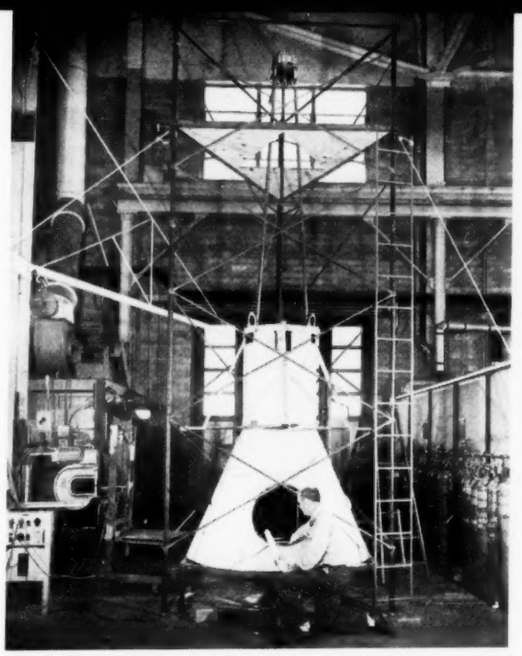
7. *Nova*, a five-stage rocket standing 260 ft. high and with a weight of 4,500,000 lb. Its first stage will be formed of four Rocketdyne single-barrel kerosene/liquid oxygen engines each delivering 1,500,000 lb. of thrust. The first engine of this type has already undergone ground tests. The second stage will be a single 1,500,000-lb. thrust motor, and the third and fourth stages one engine each of 80,000 lb. and 40.000 lb. thrust respectively, operating on liquid oxygen and liquid hydrogen. Finally the fifth stage will consist of the 6,000-lb. thrust JPL engine mentioned above.

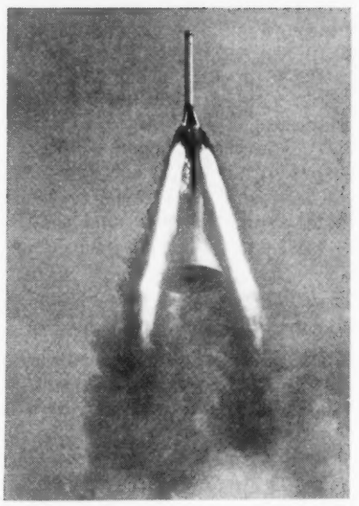
According to NASA statements, " only " five new engine types will have to be developed for this extensive programme: the 1,500,000-lb. Rocketdyne single-barrel engine, the 40,000-lb. and 15,000-lb. rockets for liquid oxygen and liquid hydrogen operation (the latter by Pratt & Whitney), a 20,000-lb. motor with integral tanks and a similar engine (6,000 lb. thrust) by JPL for storable liquids. Whereas the Rocketdyne 1,500,000-lb. unit will not be operational for some three to five years, the other power units—judging by the present state of tests—should be available very much sooner. Preliminary tests on the clustered first-stage powerplant for the *Saturn* vehicle have already begun.

What will be the value of these rocket vehicles, some of which are as big as cargo boats and weigh thousands of tons ? NASA's answer to this question is as follows:

Vega and *Centaur* could lift a payload of 7,400 lb. into an orbit close to the earth, or 13,000 lb. into an orbit 22,000 miles distant, or again transport 730 lb. for a " soft " landing on the moon. Dr. W. Pickering, Head of JPL, says that the *Saturn* vehicle would be able to lift manned or unmanned satellites weighing 19,000 lb. into a nominal orbit, or 3,300 lb. into an orbit with an apogee of 22,000 miles. Finally the booster mentioned under point 7 (total thrust 6,000,000 lb.) promises to orbit a 150,000-lb. space laboratory at 300 miles altitude, or it could land a payload of more than 19,900 lb. on the moon. According to NASA, this would be the minimum weight required for a one-man trip to the lunar surface and return to earth without the assistance of a large space station.

The ultimate aim of carrying several tons of payload to Mars and bringing 750 lb. of it back to earth could be achieved only with the *Nova* rocket. But if it is desired to send manned space stations weighing dozens of tons to Mars, probably the only suitable means of propulsion would be the successive explosion of small nuclear warheads mentioned elsewhere in this issue and already being investigated by ARPA under *Project Orion*.





While design plans for new space vehicle boosters are taking shape, National Aeronautics and Space Administration scientists are working on the *Mercury* manned satellite gondola. A mockup of the capsule, complete with escape rockets to ensure recovery of the gondola in the event of booster malfunction, was recently tested at NASA's Wallops Island centre (right).

The Scout Satellite Vehicle

It is already some long time since NASA first conceived the plan of developing a low-cost, easily handled multi-purpose rocket vehicle for satellites and other space stations. It was also to be suitable for use in re-entry tests on ICBM nose cones and to be capable of lifting satellites weighing up to 150 lb. into orbit. Cost of manufacture was to be not higher than $500,000 per rocket, so that cost per pound of payload transported into space would be very much lower than the figure obtained by the multi-stage liquid-propellant boosters now in use.

After extensive design studies, the responsible NASA planning group decided to use existing solid-propellant motors, and in April this year Chance Vought Aircraft Inc. received a provisional $945,000 contract for assembly and partial testing of the *Scout* combination. Chance Vought will undertake final assembly of the various components at its Dallas, Texas, plant and will then deliver the vehicle, in dismantled form, to NASA's Wallops Island base, Virginia, where it will be reassembled and launched.

Originally NASA scientists planned a three-stage vehicle, but a fourth stage was added after modifications had been made to the design specifications. The first stage is an Aerojet General *Jupiter Senior*, the second stage an improved Thiokol *Sergeant*, the third stage an improved X-254 rocket supplied by Allegany Ballistic Laboratory (development of the *Vanguard* third stage motor with greatly increased thrust), and finally the fourth stage will be the X-248 solid-propellant motor, also built by Allegany Ballistic Laboratory. Overall length of the *Scout* is 70 ft., and weight 35,000 lb.

The *Jupiter Senior* first stage was developed under an Army-Navy programme, since abandoned, for a submarine solid-propellant rocket and has both aerodynamic control surfaces and jet flaps underneath the rocket nozzle. The second stage—and with it the third and fourth stages—is controlled by pressure nozzles; the last two stages cannot be steered after burnout of the second stage, but they are roll stabilized during ascent. The inertial guidance system will be supplied by Minneapolis-Honeywell Regulator Co. Flight testing is expected to begin in the spring of 1960.

Model of the *Scout* satellite booster, assembly of which is the responsibility of Chance Vought Aircraft Inc.

Protected Launching Sites for the Atlas

The first *Atlas* squadron at Vandenberg AFB will have unprotected launching sites with high gantries, similar to the *Atlas* installations at Cape Canaveral, shown here.

The USAF is working at high pressure on the formation of the nine *Atlas* squadrons approved to date. The first ICBM unit to have *Atlas* missiles becomes operational this month at Vandenberg AFB, California. The launching installations for the first squadron are unprotected and have 100-ft. high gantries which, similar to the take-off platforms erected at Cape Canaveral, form a highly vulnerable target.

In view of Russia's progress in the ICBM field, the Pentagon has decided to basically design all intercontinental-range missiles developed after the Convair *Atlas* for operation from protected underground bases (cf. *Interavia* No. 4, 1959, p. 412, etc.). Reports received in the meantime on the striking power of the Soviet long-range missile forces appear to confirm that the step taken was the correct one. In fact these reports have apparently convinced the USAF planners of the need to protect some of the existing Atlas bases against blast and heat, so that the United States—up to the time when the *Titan* and *Minuteman* become available—would not lose all its operational *Atlas* missiles through a single surprise attack by several dozen Soviet ICBMs.

Thus, the USAF's Ballistic Missile Division will have three different types of *Atlas* launching sites in the next few years:

1. Surface concrete platforms with high gantries (thirteen storeys) similar to the system erected some years ago at Cape Canaveral for the *Atlas* prototypes. The missile is positioned upright in this type of launching site so that it is entirely unprotected against explosions;

2. Above-ground launching platforms inside a concrete shelter or possibly protected by banked earth, offering some protection against lateral splinters and moderate blast and heat. The missile will be kept in the horizontal position on a cradle, and when the doors open, the missile will be erected to the vertical position for firing. As the whole installation is still above ground level it provides, of course, only limited protection against atomic explosions at close range;

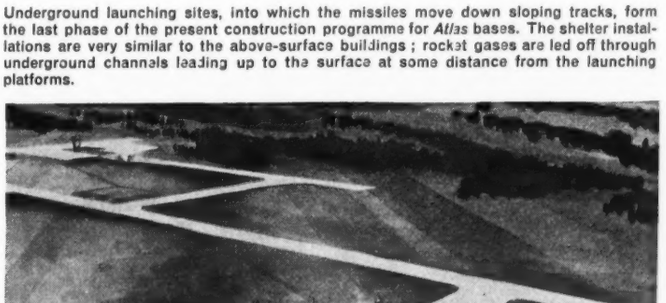
3. Partially buried coffin-type structures, with the missile again in the horizontal position. Here installations will be further protected by banked earth, and again doors will open and the *Atlas* will be erected and prepared for firing as in the second type of site.

The first of the three *Atlas* launching sites at Vandenberg Pacific missile base is of the first type. The installation, complete with gantry, was completed in January 1959. The second site, construction of which began in August 1958, is of type 2. Two similar "soft" sites are also under construction at Warren AFB, near Cheyenne, Wyoming, where two *Atlas* squadrons are to be stationed. The first site was begun in August 1958, and the second in March 1959. Another semi-protected site (type 2) at Offutt AFB, near Lincoln, Nebraska, was begun early in April 1959. Two protected bases (type 3) are also under construction at Fairchild AFB, near Spokane, Washington, and Forbes AFB, near Topeka, Kansas. In both cases, work was begun early in May. The companies responsible for construction work at Fairchild have received USAF contracts to a total value of $6,900,000. Finally, it is announced that the third base at Vandenberg will be a hardened site of the third category.

To begin with, the United States will thus have one entirely unprotected *Atlas* launching (Vandenberg AFB), four semi-protected installations (Vandenberg AFB, Offutt AFB and Warren AFB) and three protected sites (Fairchild AFB, Forbes AFB and Vandenberg AFB). Originally hardened underground sites had been projected only for the *Titan* missile, as the first *Atlas* version had radio/inertial guidance, and the cost of protecting the extensive antenna systems required would have been prohibitive. However, now that a pure inertial guidance system has been developed for the production *Atlas D* model, it has become possible to modify the planned unprotected sites and place the missiles either in shelters or partially underground. The approved modifications are being incorporated into the sites already under construction; they will not mean any major increase in cost or delay the formation of the planned nine *Atlas* squadrons.

Further *Atlas* units will receive concrete protected launching sites with scooped-out channel to divert hot powerplant gases after ignition of the rocket motors. The installations can also be enclosed by banked earth, but are above ground.

Underground launching sites, into which the missiles move down sloping tracks, form the last phase of the present construction programme for *Atlas* bases. The shelter installations are very similar to the above-surface buildings; rocket gases are led off through underground channels leading up to the surface at some distance from the launching platforms.



Towards New Appointments at the Pentagon

Fate sometimes walks strange paths . . .

The April 1959 issue of the well-known American magazine " Fortune " carried an article entitled "The Embattled Mr. McElroy" from the pen of commentator Charles J. V. Murphy. The author reviews exhaustively and objectively how businessman Neil McElroy, answering President Eisenhower's call on October 9th, 1957, to take over the top job at the Pentagon in succession to Secretary of Defense Charles E. Wilson, has since that day been involved in a constant struggle to reconcile the United States' domestic and foreign policies with the new problems constantly arising in American defence policies . . . Before his inauguration at the Pentagon he visited his predecessor Charles Wilson for a heart-to-heart talk. On Wilson's desk lay a copy of that morning's newspaper, the " Washington Post ". " Some day somebody up there on the Hill is going to throw some questions at you and tell you that you can answer freely in executive session. Don't believe 'em. Three months later you'll be seeing your words in the morning newspaper," Wilson commented wryly.

Indeed, on the morning of April 24th, 1959, political commentator Joseph Alsop's column in this same " Washington Post " contained a sharp attack on the Pentagon, and in particular on McElroy's closest collaborator, Deputy Secretary of Defense Donald A. Quarles. Alsop made Quarles the scapegoat for mistakes in the U.S. missile programme and dubbed him " Mister Missile Gap ". A Washington friend who forwarded a copy of the article to *Interavia* added that although Joseph Alsop is known for his sharp-edged commentaries, he had seldom indulged in such outspoken criticism, framing what amounted to a public denunciation.

Had Alsop had any premonition that Donald Quarles would suddenly succumb to a heart attack at his Washington home a bare two weeks later, on the night of May 7th, the article probably would never have been written. Fate sometimes walks strange paths. Overnight a new problem was added to the burden facing the U.S. Administration on the eve of the current Geneva Foreign Ministers' Conference and preparations for a Summit Conference: when he took office two years ago, Defense Secretary Neil McElroy had stipulated that he should be permitted to return to his job as president of the world-wide soap manufacturers, Procter & Gamble, in October 1959. He had accepted the top position at the Defense Department only because he was to be seconded by the scientist Quarles, who had come to the Pentagon from the industrial field in 1953, as expert in radar, missile and nuclear questions. Quarles had been tipped as the most likely successor to McElroy as Secretary of Defense. But now the man who became Assistant Secretary of Defense for Research and Development in 1953, then Secretary of the Air Force in 1955 and finally Deputy Secretary of Defense in 1957, has disappeared from the scene. In the face of this changed situation McElroy has announced that he will be staying on at the Pentagon " indefinitely ".

A word on Quarles. From comparatively modest beginnings, he began his life's work as a teacher of mathematics before joining the Western Electric Company's engineering department. Rising to the position of a Vice President with the company, he was active in the field of radar development and nuclear energy during World War II. Anyone having had personal dealings with him could not escape the impression that here was a shrewd technician, a man of science, who—projected into the political arena—had had the thankless task of trying to reconcile technical and political requirements. In person he was a serious and dedicated man of integrity, and undoubtedly was one of the personalities of our age. Responsible on the one hand for new developments, but obliged to make economy cuts on the other, he too was unable to please everyone. His programme cutbacks appeared to make him the aircraft industry's enemy, as referee in the three armed services' squabbles over the missile programme, for example, he had to decide whether priority should be given to the *Atlas* or the *Titan*, *Jupiter* or *Minuteman*, *Polaris* or some other weapon.

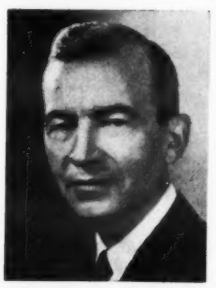
Neil McElroy is the younger man. Quarles died at the age of 64; McElroy is today 54. A tremendous worker, an outstanding negotiator and organizer, and a man who developed a world-wide market for the Procter & Gamble products. As Defense Secretary his task has been to make the constantly changing programmes of the U.S. defence policy palatable both to the Congress and to public opinion, despite the fact that in military matters he was a comparative novice. Donald A. Quarles was his trusted and valued right hand.

If it had been only the almost daily hearings in Congress, with their difficult questions, which he had to face! But he had also to cope with the services and their highly energetic and voluble generals, each of whom is anxious to cut off the biggest slice of the financially limited defence budget cake for his own service. Top priority for the ballistic missile programme? The Navy regards its nuclear-powered, missile-carrying submarines as the most important weapon. General Schriever has other ideas, and General LeMay, Vice Chief of Staff of the Air Force, doubtless views the Strategic Air Command's fleet of eight-jet bombers and four-jet tankers as the alpha and omega of all offensive power . . . " The Embattled Mr. McElroy ".

Immediately after Quarles' death Washington was alive with rumours as to who was the most likely candidate for his succession. Names such as Cabot Lodge, of the United Nations, General Gruenther, former NATO Commander-in-Chief, the Secretaries of the Army or the Navy, went the rounds. As late as May 14th, the " New York Herald Tribune " reported from Washington that President Eisenhower was looking for a " man of stature outside the Pentagon ". Finally, on May 18th, 1959, a decision was taken, and it was announced that Thomas S. Gates, Jr., Secretary of the Navy since April 1957, was to succeed Quarles. Will McElroy stay in his post of Secretary of Defense until the end of the Eisenhower term? Will he be replaced by Gates? Or by somebody else?

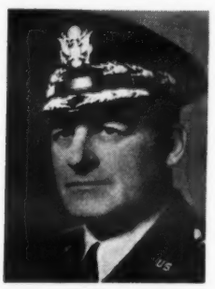
The key posts at the Pentagon certainly appear to be a constant source of worry for the Administration. During the second week in May it was suddenly announced that yet another pillar of the American defence organization was threatened. General Nathan F. Twining, former Chief of Staff of the Air Force, and today Chairman of the Joint Chiefs of Staff, is suffering from cancer of the lung and has had to undergo an operation. The United States President truly has his share of troubles . . . so many of his colleagues succumb to the " managers' disease " or the 20th century scourge against which medicine is still powerless, plunging the two most important departments—the State Department and the Pentagon—into personnel crises within so short a period.

Neil H. McElroy, U.S. Secretary of Defense.



The late Deputy Secretary of Defense, Donald R. Quarles.

The newly appointed Deputy Secretary of Defense, Thomas S. Gates, Jr



General Nathan F. Twining, Chairman of the Joint Chiefs of Staff.

"Fielding's Travel Guide to Europe"

Some weeks ago a friend in New York lent me a book entitled " Fielding's Travel Guide to Europe ". He wrote thus—" Enjoy reading it, you will have a lot of pleasure from it." At that particular time our Editors were engaged in producing a 200-page edition in four languages so other pleasures were denied them. Fielding was left on one side.

Meanwhile there appeared in the " New York Herald Tribune " (Paris edition) dated May 8th, 1959, under the title of " Fielding and the Europeans " a book criticism of this promising work written by Robert Sage. This critic said that Fielding's European Guide had got better and better during the last four or five years, that the author had become more tolerant, but that the very personal note of this travel guide still remained. Sage then cited some examples of Fielding's style such as—" The Swiss are often colder than the snow on their glaciers, " or " the French home is too often ready for Lysol or some such cleaner " and " the Parisian buildings are old and decrepit ".

Obviously a refreshing book, so I decided one evening to glance at Fielding myself. I must admit the reading is worth while.

Temple Fielding was born in the year 1913, and his 934-page Guide, in contrast to many other travel books, never becomes boring. Through some investigation I learn that from the comfort of his home in Formentor on the Island of Mallorca, a climatic and scenic Paradise, he has obviously spent the greater part of the year travelling with his eyes open. I would recommend many Europeans, particularly the members of air traffic companies, to read this book (published by William Sloan Associates Inc. in New York. Price $4.95), but then I remembered my friends of the International Air Transport Association (IATA) and do not wish to hurt their feelings. Then listen and wonder ! I learned from the text that Fielding is not merely a convinced air traveller and no more, but almost an expert on certain questions of air travel who does not hesitate to criticise the most august air transport institutions.

*

His book is well illustrated with points:

" By air, over-ocean rates on all scheduled carriers (except Icelandic Airlines) are exactly the same. An organization called the International Air Transport Association (IATA) is responsible for this questionable practice. Regardless of which line you select, you'll be rocked the cartel price of $453.60, as one example, for an economy-class seat New York-London round trip against $228.80 New York-Los Angeles round trip—a distance only one quarter less ! This far-flung octopus, made up of 86 airlines, also regulates everything from the spacing of the seats to the nature of your free hand-baggage to the type of sandwich served aloft." And on page 49 he continues in the same strain...

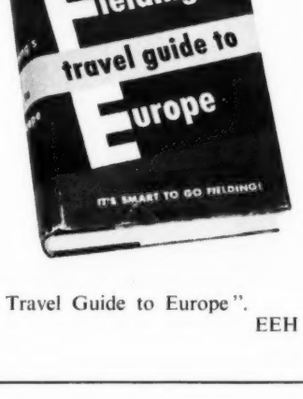
" Many travel professions seem to agree that international aviation is overdue for an industry-wide shake-up. Year after year, an important segment of the trade has become more and more alarmed about the increasingly callous concept of the carriers and their regulatory bodies towards that Low Man On The Totem Pole, John R. Smith, the average ticket holder... But now that their traffic volume has suddenly skyrocketed through the skylight, there's a disquieting general trend toward what we might call ' cattle-car thinking '... For this premium price, the passenger has every right to expect a comfortable, relaxed ride—and in most cases, he just isn't getting it. Much of the onus falls upon The International Air Transport Association (commonly called IATA), which dictates the foreign rule book to every scheduled transatlantic airline except Icelandic.

" IATA represents itself as a ' voluntary ' alliance which ' unanimously ' enacts all regulations and fares pertinent to its membership, after approval by the various governments. This description stretches the actuality to the limits of charity. If 1 or 2 or 8 or even a dozen of its smaller members should demand a showdown on any specific issue, and should stand up unflinchingly against the steam roller, they eventually end up with 2 options: 1) to surrender ' voluntarily ' and ' unanimously,' or 2) to get out of the organization, practically as of 60 seconds ago. The glue which holds everybody so rigidly in line, and which pastes together some of the astonishing compromises between power blocks which have emerged from its conferences, is the universal, nearly pathological fear of a price war in the air.

" ' We loathe our IATA headaches and all they stand for,' we have been told behind closed doors. ' Nevertheless, it's still wiser for us to operate within a solid, industry-wide front than to have our throats cut by competition which sells for less and gives more.'

" But where does this philosophy leave the public ? "

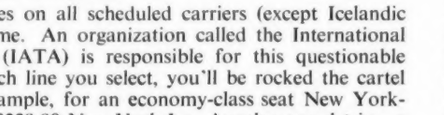
This sample should suffice from " Fielding 1958/60 ".



There remains the open question—IATA's reaction. Certainly on the grounds of their world-wide importance they may gloss over Fielding's comments in silence, but obviously the book is appreciated and widely read in the USA to account for the demand for a twelfth edition. At worst they can buy the whole of Fielding's edition, but this is a far-fetched step. They can probably be expected to contest his remarks, as IATA always indignantly rejects any suggestion of cartel building.

Enough for today on " Fielding's Travel Guide to Europe ".

EEH



Jet Propulsion Engines. Editor O. E. Lancaster. Published by Princeton University Press, Princeton, N.J., 1959 (English; 799 pages; price $20).

This publication forms the twelfth and last volume of a series entitled " High Speed Aerodynamics and Jet Propulsion ". The twelve volumes are the result of an Aeronautics Publication Programme which was established at Princeton University in 1949 with Dr. Theodore von Karman as Chairman of the Editorial Board.

Throughout the whole twelve volumes the intention of the editors has been to emphasize the fundamental aspects of jet propulsion and high speed aerodynamics, to develop the theoretical basis from which to approach these problems, and to endeavour to indicate the direction in which research would prove most profitable.

The last volume also follows this pattern. It is subdivided into twelve sections covering the complete field of jet propulsion, from rockets to a possible nuclear jet powerplant suitable for aircraft. This is not merely a review of engines which are in service, but a painstaking analysis of current knowledge of engine theory and possible future applications.

So rapid is development in these fields today that some of the bibliography would appear to be dated. This is a regrettable penalty in a work of this nature as the time elapsing between the collation of the material and its final publication is always protracted. This does not detract however from the intrinsic merit of a work which will be of considerable value in both the training of the aeronautical scientist and in industry. E.K.B.

Sputniks and After. By Karl Gilzen (translated from the Russian by Pauline Rose and Dmitri Nesteroff)—Published by Macdonald & Co., London, 1959 (English, 285 pages; 21 shillings).

Perhaps only the author can tell us what audience he had in mind when he wrote this book. Certainly the reader who is tempted by the title and dust-jacket of this Soviet account of travel in space is doomed to both frustration and disappointment. The repetition of praise for Soviet achievements, Soviet scientists and Soviet political doctrines is irksome though understandable, but the information it actually contains concerning the *Sputniks* is negligible. The author deals with astronomy and the growth of astronautics at great length, but as to the questions on how the *Sputniks* were launched, what vehicles were used, and where they were launched from, the reader is left speculating. Perhaps his perplexity is no greater than that of the author's, whose sources of information would appear to be mainly in the Western world, judging from the fact that on page 78 he publishes—without acknowledgement—a drawing of an atom-powered rocket by artist John W. Wood for Kenneth W. Gatland's 1952 edition of the book " Development of the Guided Missile " (the drawing is reproduced on page 217 of the second edition published in 1954).

This lack of concrete information on the *Sputniks*—and reference to them fills only a small fraction of the book—is perhaps best exemplified by the author's description of their launching. In this he states a multi-stage rocket was used and an idea of the arrangement

" can be had from the American Vanguard ". With that the reader must rest content.

Illustrated by a number of uninformative photographs which have appeared previously in newspapers of the Western world, the book will not contribute greatly to knowledge of Russian space travel development.

Out of charity to the author, one can only suppose that it was originally written as a popular science work for junior readers; it has gained nothing in translation.

E.K.B.

Technische Strömungslehre (5th Edition). By Bruno Eck. Springer Verlag, Berlin-Göttingen-Heidelberg, 1957 (German; X+422 pages; 407 illustrations; price cloth-bound, DM 29.40).

A new edition of a book first published in 1940 (based on the same author's earlier " Einführung in die technische Strömungslehre "), this thoroughly prepared textbook, which has been considerably broadened in scope during the past few years, gives two basic categories of information: 1. a description of the main laws of fluid flow in the simplest possible form; 2. a collection of research results of direct practical value. Thanks to this simple approach and a style which is concise enough to appeal to the technical man, this book, repeatedly revised and brought up to date over the past two decades, has won for itself a wide circle of readers. Ri.

Vingade Vapen. By Gösta Norrbohm and Lars Ljusberg. Verlag AB Allhem, Malmö, 1958 (Swedish; 154 pages; Sw.Kr. 7.—).

Attractively presented as regards both pictures and text, the book gives a picture of the future war in the air with jet aircraft, atomic bombs and guided missiles. The text is easy to read and is supplemented by many illustrations and explanatory diagrams. Of particular interest are the maps of the USAF bases outside the United States, and in contrast, a map of the missile bases and production centres presumed to exist in the USSR. Several chapters deal with the tactics of aerial war and the new problems facing the commanders of land troops due to the availability of high-destruction weapons. The final chapters of this book are devoted to specific Swedish or Scandinavian questions, for example, " Scandinavia's Role in a West-East Aerial War " or " Scandinavia Seen from Russia's Point of View ". Ba.

Atomterminologie, by Lore Lettenmeyer. Published by Verlag Max Hueber, Munich, 1958 (English, German, French, Italian; 298 pages; price DM 24.80).

This small technical dictionary in four languages, English, German, French, Italian, contains nearly 2,000 of the most current terms and expressions used in nuclear physics. The main part of the book is in English, the words being arranged alphabetically. A French, German and Italian index, however, based on a word numbering system, enables any desired expression to be quickly located. Its compact size prevents the inclusion of highly specialized terminology, but users will reap the benefit of its lucid presentation founded on the author's experience as a European Coal and Steel Pool translator. Ka.

The Tale of the Comet. By Derek D. Dempster. Allan Wingate Ltd., London, 1959 (English; 218 pages and illustrations; price 21 shillings).

" Tired and weary, not so much with flying, but with the intricacies of finance with which he had been forced to juggle through the precarious years that followed the grounding of the first *Comet*, Sir Geoffrey de Havilland had stayed at home. It was the first time he had missed the first flight of one of his aircraft in fifty years in aviation which he had entered at the age of twenty-six." This description of Sir Geoffrey de Havilland after the first flight of the *Comet 4* in 1958 shows how interwoven among the pages of this book are recounted some of the disappointments and, too, the successes in the history of aviation progress. The purely personal tragedies of Sir Geoffrey—the loss of his two sons, Geoffrey and John, both killed while testing their father's aircraft—are irrevocably written into the story of the de Havilland organization.

Derek Dempster recalls how during the war it was left to the United States to build transport aircraft for the Allied forces. When the peace came, de Havilland decided to build an aircraft using Britain's one trump card—the Whittle engine. *Comet 1* was intended to be " a thirty-six passenger aircraft with the speed of a fighter " but unforeseen technical problems came along: the operational economics of jets obliges them to fly high where pressures necessary for passenger comfort strain to burst cabin walls apart against the lower pressures outside. Although pressurization is now a highly specialized branch of aeronautical engineering there were many unknowns in those early days.

In the words of the author, " no aircraft has contributed more to safety in the jet age than the *Comet*. The lessons it taught the world of aeronautics live in every jet airliner flying today. Many of those lessons came from the water-tank test designed to reveal the weaknesses of the pioneering *Comet 1*: a test every modern airliner must endure before it can be given the freedom of the skies."

The determination and engineering skill of the de Havilland organization combined with the confidence of BOAC, and indeed the British Government, enabled the *Comet* to emerge from its earliest beginnings and initial setbacks as one of the world's foremost airliners.

Tu.

Starten und Fliegen. Das Buch der Luftfahrt und Flugtechnik, Vol. III compiled by Otto Fuchs and Wolfgang von Gronau, Eugen Sänger, Richard W. Schulz. Editor, Hans-Joachim Luz.—Deutsche Verlagsanstalt, Stuttgart, 1958 (German; 288 pages; 270 illustrations; price, cloth-bound, DM 14.80).

This annual book on aviation . . . and astronautics, the 1956 and 1957 editions of which were reviewed in *Interavia* (No. 2, 1957 and No. 4, 1958), has found the secret of always presenting the reader with what is really important in today's aviation developments and ignoring all secondary matters. " The both difficult and gratifying task of explaining a branch of learning to a circle of readers beyond the experts, particularly to the younger generation, could scarcely have been better tackled than here " . . . These words by Professor von Karman in his introduction will be echoed by all readers. Incidentally, the names of the contributing authors and the subjects they have chosen speak for themselves. Examples are: Prof. Günther Bock (Darmstadt Institute of Technology) on " High-Speed Flight "; Gerhard Fieseler on " World Aerobatics Championship "; Wilfrid A. Pulver, Chief Engineer, Lockheed's Georgia Division, on " The JetStar Story "; Prof. Otto Lutz, Chairman of DFL, on " Propulsion Questions for Tomorrow's Air Transport "; Erich E. Syamken, head of the Esso Aviation Division (Germany), on " From the Refinery to the Aircraft Tank "; Dr.-Ing. Walter Just, " 25 Methods of Vertical Take-Off " . . . In addition, there are the usual brief, illustrated descriptions of modern military and civil aircraft. A good buy. He.

Rocketry and Space Exploration. By Andrew G. Haley. D. Van Nostrand Company, Inc., New York, London, Toronto, 1958 (English; 334 pages including appendices and index; price $6.75).

When an author's preface pays tribute to a master of English composition, John Henry Newman, a high standard of writing can be expected. Andrew G. Haley, President of the International Astronautical Federation, and a lawyer, has written a readable, as well as instructive book.

Did you know that a rocket motor burns a solid self-oxidizing fuel, while a rocket engine runs on liquid fuel with elaborate pumping equipment, but that *rocket motor* is preferred as the generic term? This according to USAF preference. Rocket technology is discussed from Archytas—a 4th century B.C. Greek and his steam propelled wooden pigeon—to *Tiny Tim* and *Little Joe*, *Vanguard* and astronautics, and on to nuclear-powered interplanetary vehicles.

The author considers that ion propulsion (electrically charged particles of matter exerting thrust on the electrical or magnetic apparatus that accelerates these particles) is being investigated by all three of the major rocket building countries. Tu.

Le Statut Juridique de l'Aéronef Militaire. By Ming-Min Peng. Martinus Nijhoff, The Hague, 1957 (French; 129 pages; price 11.40 guilders).

It could, of course, be asked whether, in view of the present increasing switch-over to missiles, it is still worth while engaging in a detailed discussion of the legal position of military aircraft of conventional varieties. From the scientific and practical points of view, this question must be answered in the affirmative; from the scientific point of view because the theory of space law can be successful only if it is based on air law, and from the practical point of view because the military aircraft is still by no means played out, whether as fighter or bomber, or—still less—as transport aircraft.

Ming-Min Peng's study is of particular importance since it is basically the first systematic overall survey of the subject; hitherto only papers on special aspects of the problem have been available. Moreover, ICAO legal experts have paid considerable attention to the military aircraft. The first part of the book deals with the historical foundations: development of air law from the early days of powered flight up to the post-World War II period; definition of a military aircraft; registration of aircraft and legal position of the crew; military aircraft over the high seas and over foreign territories, etc. The second part is devoted to the legal status of military aircraft in wartime (neutral countries, etc.). A worthwhile contribution to legal literature. He.

The Aeroplane Directory of British Aviation (incorporating " Who's Who in British Aviation "), 1959 Edition. Temple Press Ltd., London, 1959 (English; 610 pages including general index; 30 shillings).

There is little new to be said about the 1959 edition of the Aeroplane Directory except that it has been thoroughly revised and brought up to date in all sections. The contents include particulars of such new organizations of major importance as Bristol Siddeley Engines Ltd. and English Electric Aviation, Ltd. It is, of course, as useful as ever and is the standard reference book of British aviation. Tu.

Jets and Rockets. By A. Barker, T. R. F. Nonweiler and R. Smelt. Chapman and Hall Ltd., London, 1959 (English; 268 pages including 121 illustrations, appendices and index; price 35 shillings).

When a Senior Design Engineer of the United Kingdom Atomic Energy Authority, a Senior Lecturer in Aerodynamics from Cranfield, and the Head of an industrial Gas Dynamics Division (formerly Head of the Royal Aircraft Establishment's Guided Weapons Department) get together and compile a book on jets and rocketry, it is not surprising that the subject matter receives adequate treatment.

The authors have gone to considerable lengths to sift and collate all the data applicable to the design of high speed propulsion systems. A large part of the book is devoted to aerodynamics—an increasingly important aspect of jet engine design. Such subjects as rocket propulsion systems and their performance, jet propulsion engines—their design and construction, and also ramjets, are discussed with sufficient non-mathematical treatment to make the book of interest to the general, as well as to the more specialized, reader.

The difficulties associated with meeting the dual speed requirements of an aircraft, such as a long flight at low speed with a short burst of very high speed, by propeller, turbojet, ramjet, and rocket thrust combinations, are examined at length. Tu.

The Army Air Forces in World War II (Volume Seven—Services Around the World). Edited by Wesley Frank Craven and James Lea Cate. University of Chicago Press, Chicago; Cambridge University Press, London; The University of Toronto Press, Toronto; 1958 (English; 667 pages including 80 pages of notes and index; price $8.50).

It is a military maxim that the administrative tail must never be allowed to wag at the expense of the operational head. This seventh and final volume describes how the *services* (i.e., Air Transport, Engineers, Personnel, Supply, Meteorology, Communications, Morale, etc.) common to the whole of the United States Army Air Forces participated in the air offensive. The editors of this book point out that much of its contents have probably appeared in the earlier volumes as the *services* were so inextricably associated with air combat in the various air campaigns.

The problems of the *services* hinged about provision and supply of men and matériel—in the broadest possible sense—for technical warfare, and too the difficulties arising from the intricacies of *command* and *control*. These organizational " struggles " well illustrate the complexity of modern war.

Air Transport Command was the biggest and the most important *service* organization, and incidentally a major user of the other *services*. Its history is traced from early dependence upon the commercial airlines, and struggle for a separate and corporate existence, to the role played by the renowned Douglas DC-3 (alias C-47 and C-53) in the various theatres of war. Tu.

British Plastics Year Book 1959. A Classified Guide to the Plastics Industry. Published by Iliffe and Sons Ltd., London, 1959 (English; 644 pages; 42 shillings).

This revised edition of the British Plastics Year Book contains the addresses of some 4,500 firms associated with plastics both in Great Britain and elsewhere. The Who's Who section, however, confines itself to British personalities.

The tables of the comparative properties of plastics materials have been brought up to date. The glossary of more than 200 technical terms has been revised. There are sections listing the new British companies registered in 1958 (approximately 70) and the British Standard Specifications relating to the plastics industry. A general index is included in the contents. Tu.

Electronic Engineers' Reference Book, 2nd Edition. General Editor L. E. C. Hughes. Published by Heywood & Co. Ltd., London, 1959 (English; 1,588 pages; 84 shillings).

The publication of the second edition of this reference book within a year is adequate indication of the demand which exists for a work of this nature. The basic layout of the book remains unchanged. The preliminary pages contain a number of articles on the history of electronics, pure and applied science, the human observer, after which the book is divided into nine main parts: Fundamentals, Radiations, Electrics, Valves, Materials, Vibrations, Computers, Automation and Miscellaneous. A considerable amount of revision has been done, and there are approximately 350 extra pages of text. The editor's intention has been to collect and present the latest information and developments in many applications of electronics, each section being written by an authority in that particular field. The result is not merely a collection of figures and formulae but provides an indication to the engineer of the progress that is being made in other fields of the electronics industry, and of the uses these new developments can have in his own sphere. E.K.B.

Books received

Publications scientifiques et techniques du Ministère de l'Air; distributed by the Service de Documentation et d'Information Technique de l'Aéronautique, Paris 1958:

No. N.T. 77: Actes des colloques de calcul numérique; Caen 1955 — Dijon 1956.

No. N.T. 78: Représentation directe par analogie rhéoélectrique des gradients de fonctions harmoniques en domaine plan limité ou illimité, by Guy Renard.

No. N.T. 79: Contribution à l'étude des ultrasons aériens: production et applications, by Raymond Boucher.

No. B.S.T. 121: Ecoulement des liquides visqueux dans des canaux resserrés, ses lois, ses applications, by Maurice Brunet.

No. B.S.T. 122: Caractéristiques des aciers; Résultats des essais systématiques effectués par l'établissement aéronautique de Toulouse.

No. 346: Nouveaux compléments d'hydraulique (Part 3), by Professor L. Escande.

No. 347: Influence de l'hystérèse capillaire sur l'écoulement d'un liquide; Cas des oscillations dans un tube en U; Application aux métaux fondus, by M^me^ Huetz-Aubert and J. Huetz.

No. 348: Résolution par analogie électrique d'équations aux dérivées partielles du quatrième ordre intervenant dans divers problèmes d'élasticité, by Jean Boscher.

Berichte der Deutschen Versuchsanstalt für Luftfahrt e.V.; distributed by the Zentrale für Wissenschaftliches Berichtwesen der DVL, Mülheim, Ruhr; Westdeutscher Verlag, Cologne and Opladen, 1958/59:

Report No. 22: Untersuchungen zur therapeutischen Anwendung des Sauerstoffmangels (1. Mitteilung), by S. Ruff, K. Krieger, G. Schäfer, W. Hartwich, O. Wünsche, H. Braun, H. Hansteen (price DM 29.10).

Report No. 48: Eine Näherungsmethode zur Berechnung der Geschwindigkeitsverteilung nicht angestellter gepfeilter Flügel grosser Streckung bei kleiner Dicke in Unterschallströmung, by F. Keune (price DM 14.85).

Report No. 56: Prüfstände zur Messung der Druckverteilung an rotierenden Schaufeln, by K. Leist and W. Dettmering (price DM 25.80).

Report No. 57: Spannungsoptische Untersuchungen von rotierenden Scheiben mit exzentrischen Bohrungen, by K. Leist and J. Weber (price DM 22.65).

Report No. 58: Einfluss der Fluggeschwindigkeit auf die Wirtschaftlichkeit von Strahltriebwerken und Raketen, by G. Fellner (price DM 15.00).

Report No. 61: Über die Aerodontalgie und andere Aerodontopathien, by W. Freitag (price DM 13.10).

Report No. 62: Untersuchungen über die Strahlungscharakteristik eines Fächerfunkfeuers, by A. R. Wendlinger and M. Raab (price DM 16.40).

Report No. 64: Zur Prognose menschlicher Leistungsfähigkeit, by G. Betzien (price DM 9.85).

Report No. 65: Vergleich von Gleichdruck- und Verpuffungsgasturbinen, by K. Graf (price DM 30.00).

Report No. 66: Nicht-angestellte Körper kleiner Spannweite in Unter- und Überschallströmung, by K. Keune and K. Oswatitsch; Die theoretischen Arbeiten über schallnahe Strömung am Flugtechnischen Institut der Königlich Technischen Hochschule, Stockholm, by K. Oswatitsch (price DM 8.40).

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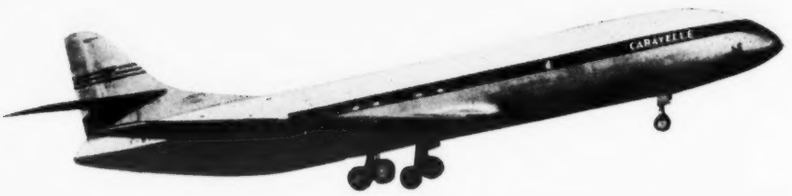

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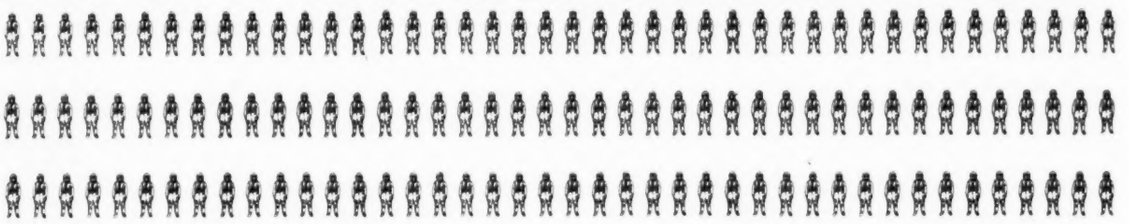

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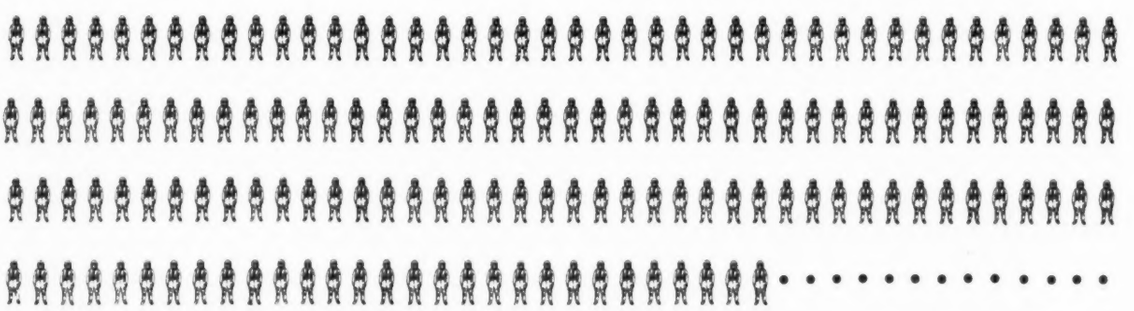

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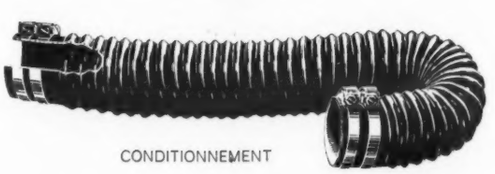

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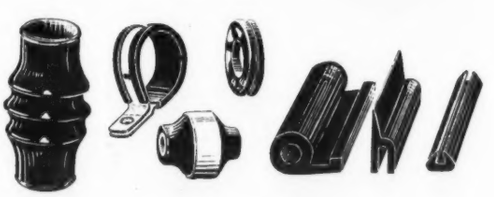

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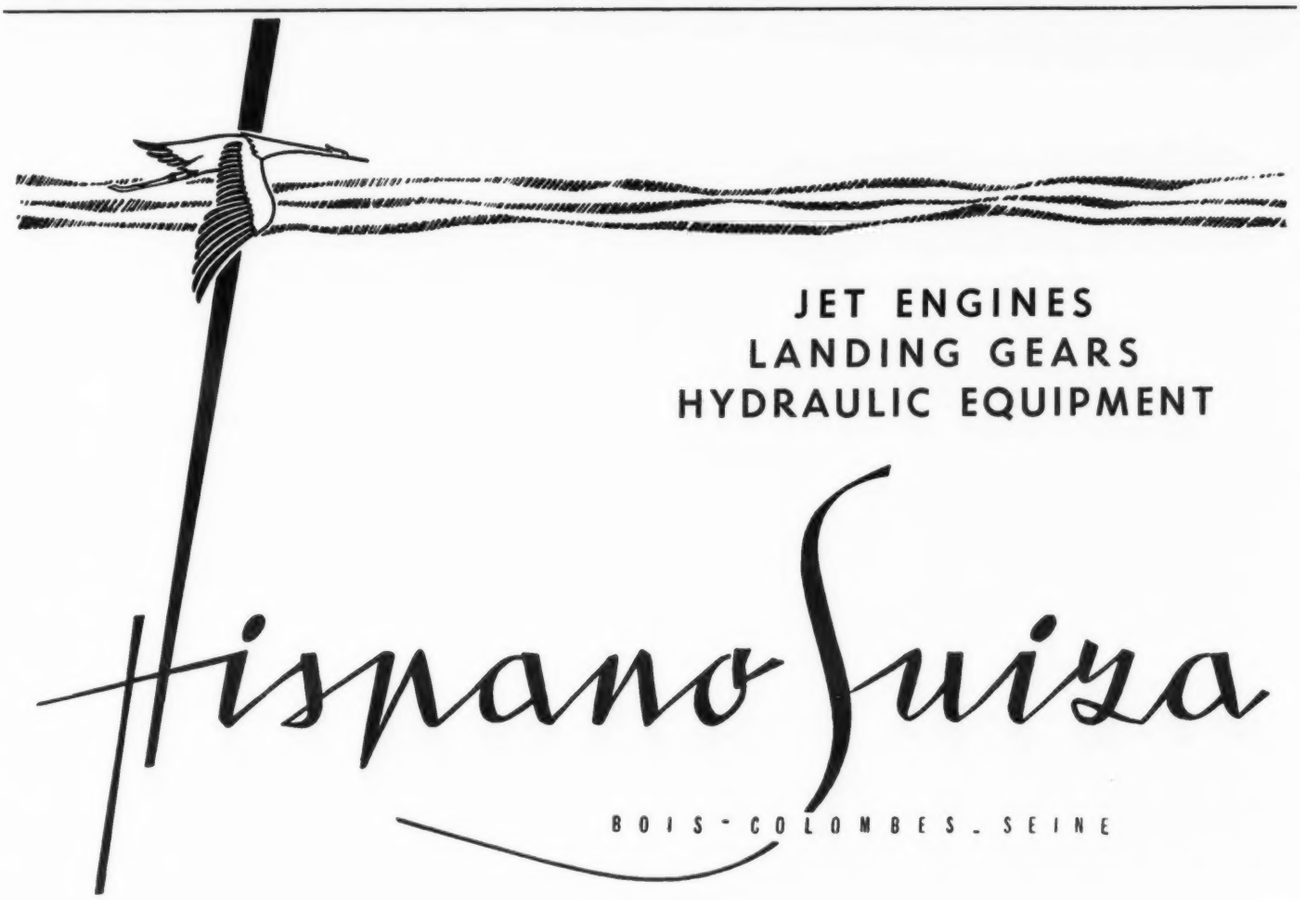

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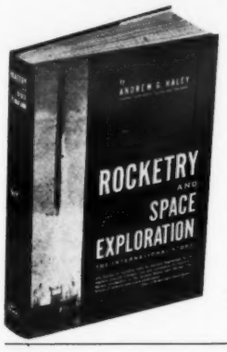

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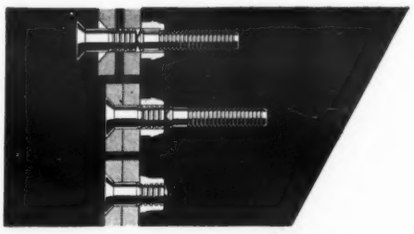

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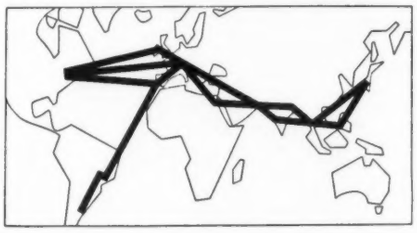

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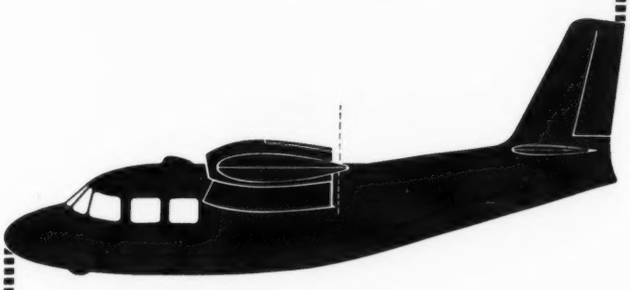

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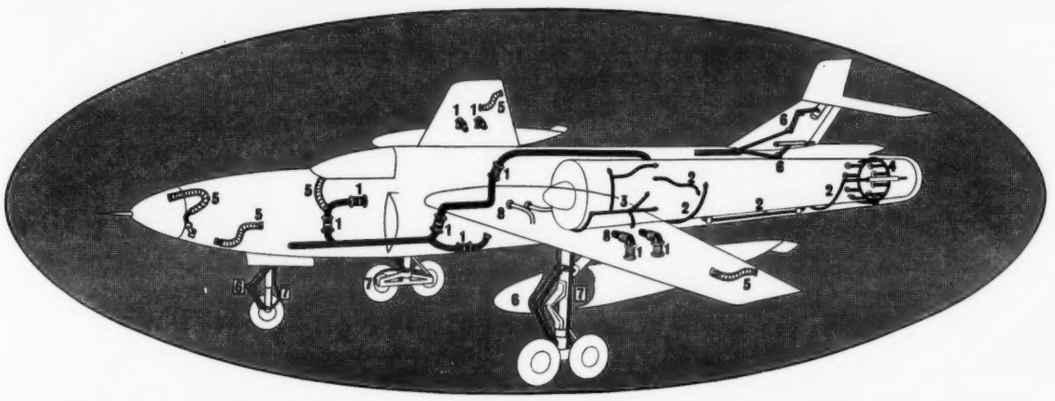

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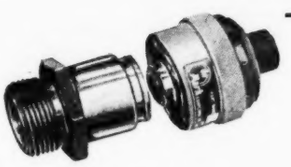

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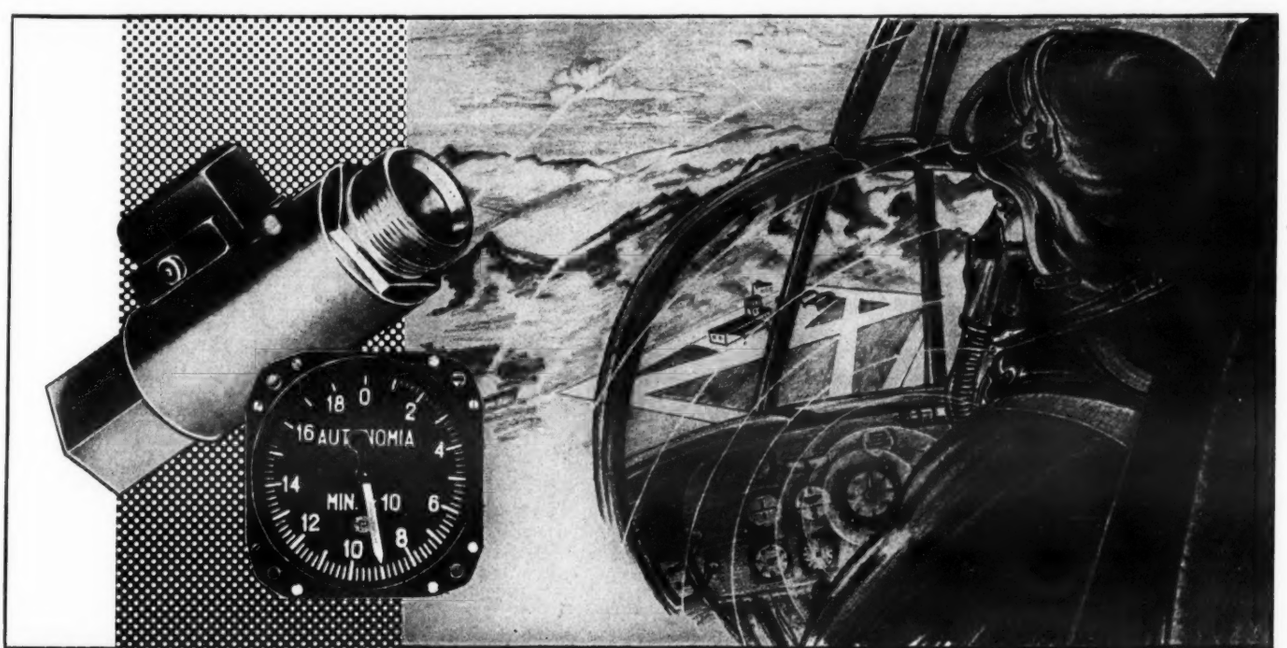

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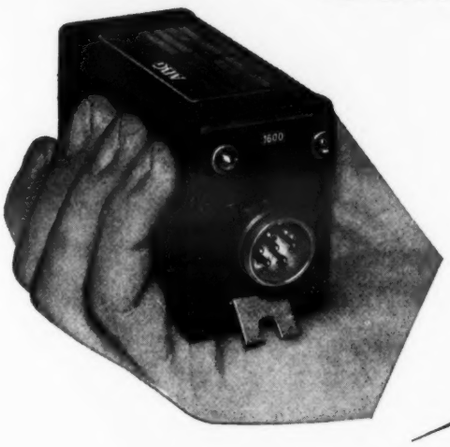

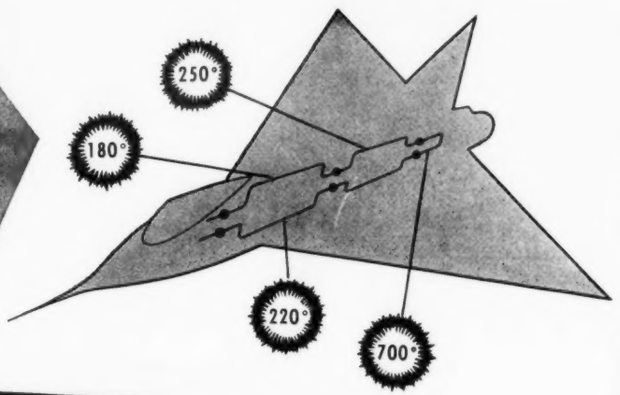

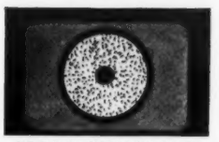
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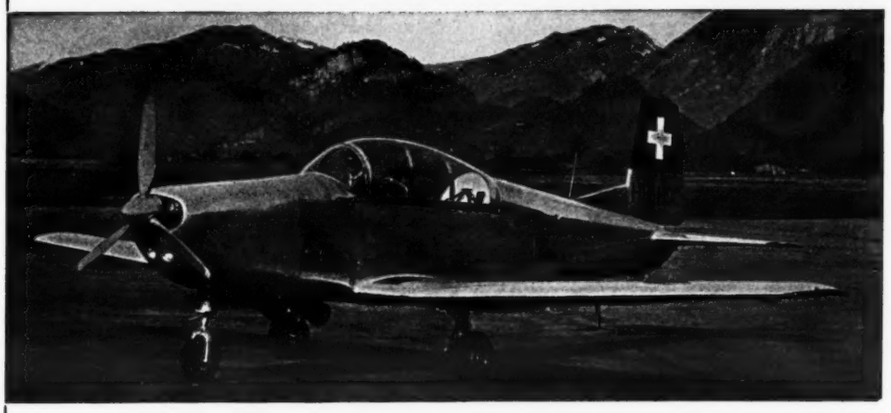

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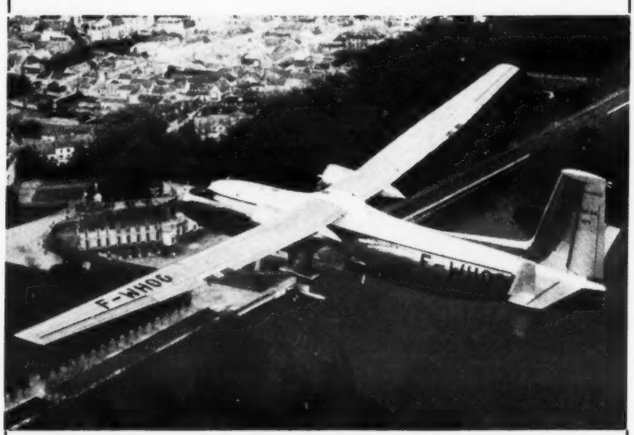

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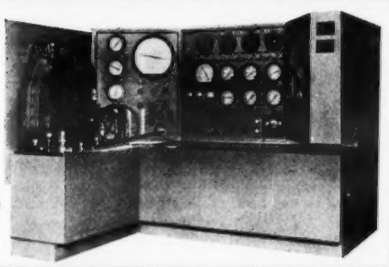

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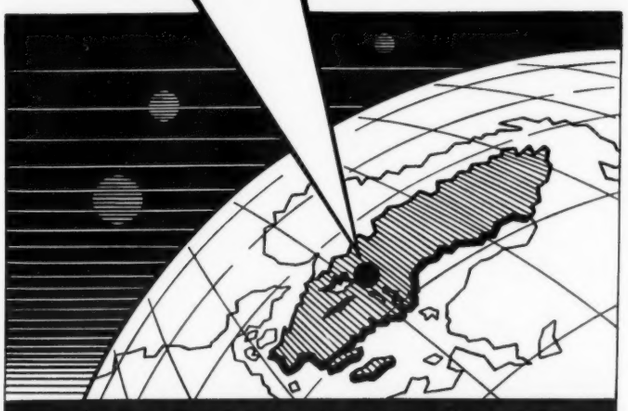

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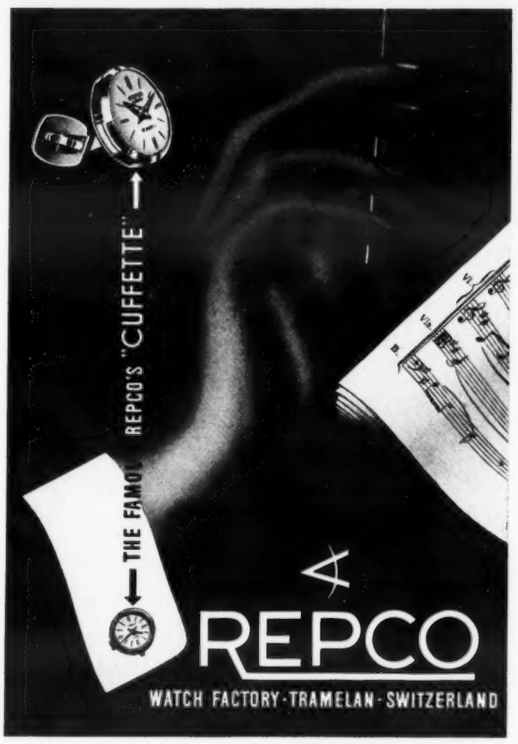

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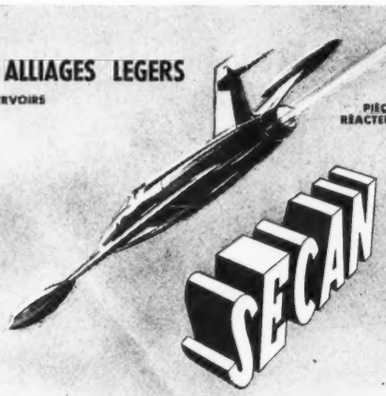

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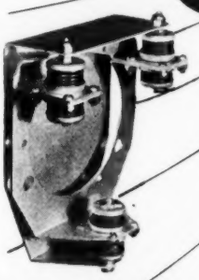

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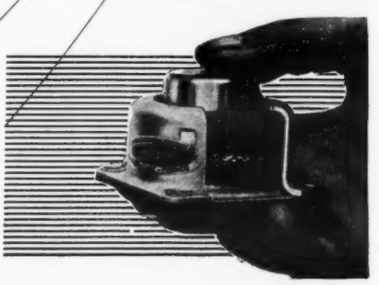

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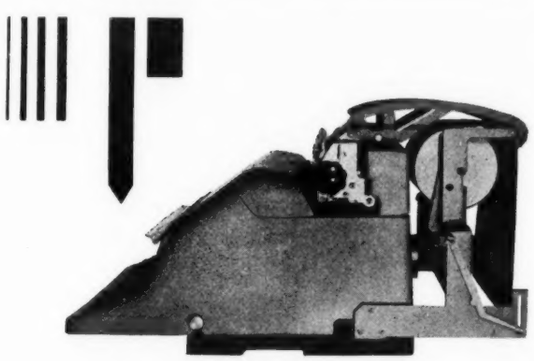

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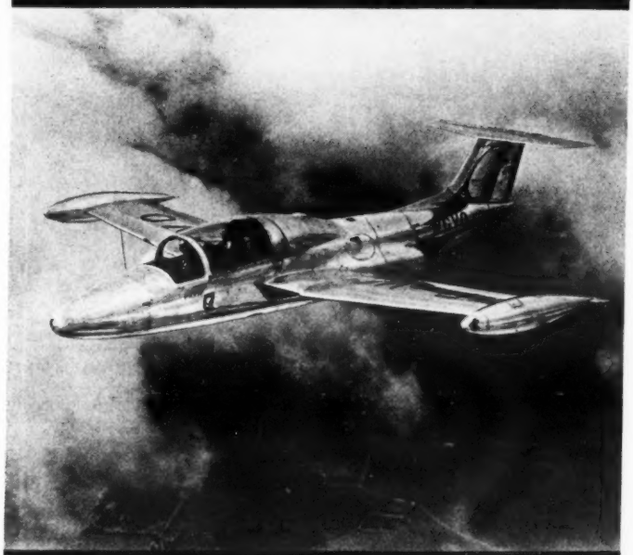

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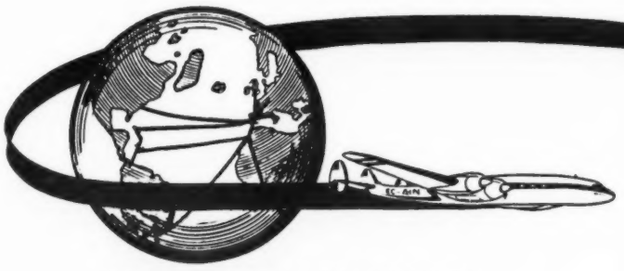

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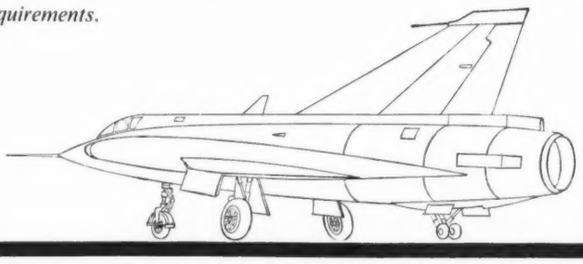
Draken

a realistic solution to the air defence problem

There's no short-cut to effective air defence. What counts is capability to perform a given task at reasonable cost. Good fighter performance alone is not effective defence against modern bomber attack. The fighter must also carry efficient weapons and all the complex electronic equipment required to find and destroy the enemy, even at night or in bad weather. The SAAB-35 DRAKEN has been found to meet these requirements. SAAB and the Royal Swedish Air Force worked together to develop, in the DRAKEN, an effective weapon system procurable at reasonable cost.



SAAB

...The DRAKEN is already in full-scale production and will soon go into service with the Royal Swedish Air Force.

...The DRAKEN has in its present production version—the 35 A—a top speed of Mach 1.8 and an initial climb rate of approx. 40,000 ft. per minute (200 m/sec.).

...The DRAKEN in the 35 B version with a more powerful Rolls-Royce engine and other improvements, has a top speed of Mach 2+ and an initial climb rate of approx. 50,000 ft. per minute (250 m/sec.), a higher service ceiling, and a considerably greater range. It is equipped with an ultramodern fire control system developed by SAAB for collision-course tactics. In addition to up-to-date fighter armament (rockets and guided missiles), it can carry (as an alternative) a heavy load of air-to-ground rockets or bombs for attack missions. In tests, the DRAKEN has shown itself to be an exceptionally good weapons platform for guns, rockets and bombs. It has also been found that even with heavy external armament, the DRAKEN still performs very well throughout the entire speed range.

...The DRAKEN's excellent handling qualities at low speed allow using small and shrouded airfields.

...The DRAKEN has full radar and navigation equipment for all-weather operations.

...The DRAKEN is designed for low-cost production without extensive use of expensive tooling or specialized heavy machinery. It offers many advantages for production under license.

...The DRAKEN has been developed by an up-to-date industrial enterprise with more than 8,000 employees—including 1,500 engineers—and the most modern technical resources.

...The DRAKEN is produced by an enterprise with more than ten years of experience in large-scale production of high-speed jet fighters.

SVENSKA AEROPLAN AKTIEBOLAGET *(SAAB AIRCRAFT COMPANY)* - LINKÖPING - SWEDEN

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The elegance of Convair's 880 and 600 Jet-Liners will set standards for luxury travel in the new jet age. Foremost in designing for jet-travel comforts, Convair *Human Engineering* experts have assisted in creating new concepts in color, lighting, and interior appointments. Every modern convenience, comfort, and luxury will be yours in Convair Jet-Liners—truly elegance that is *years ahead for years to come!*

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